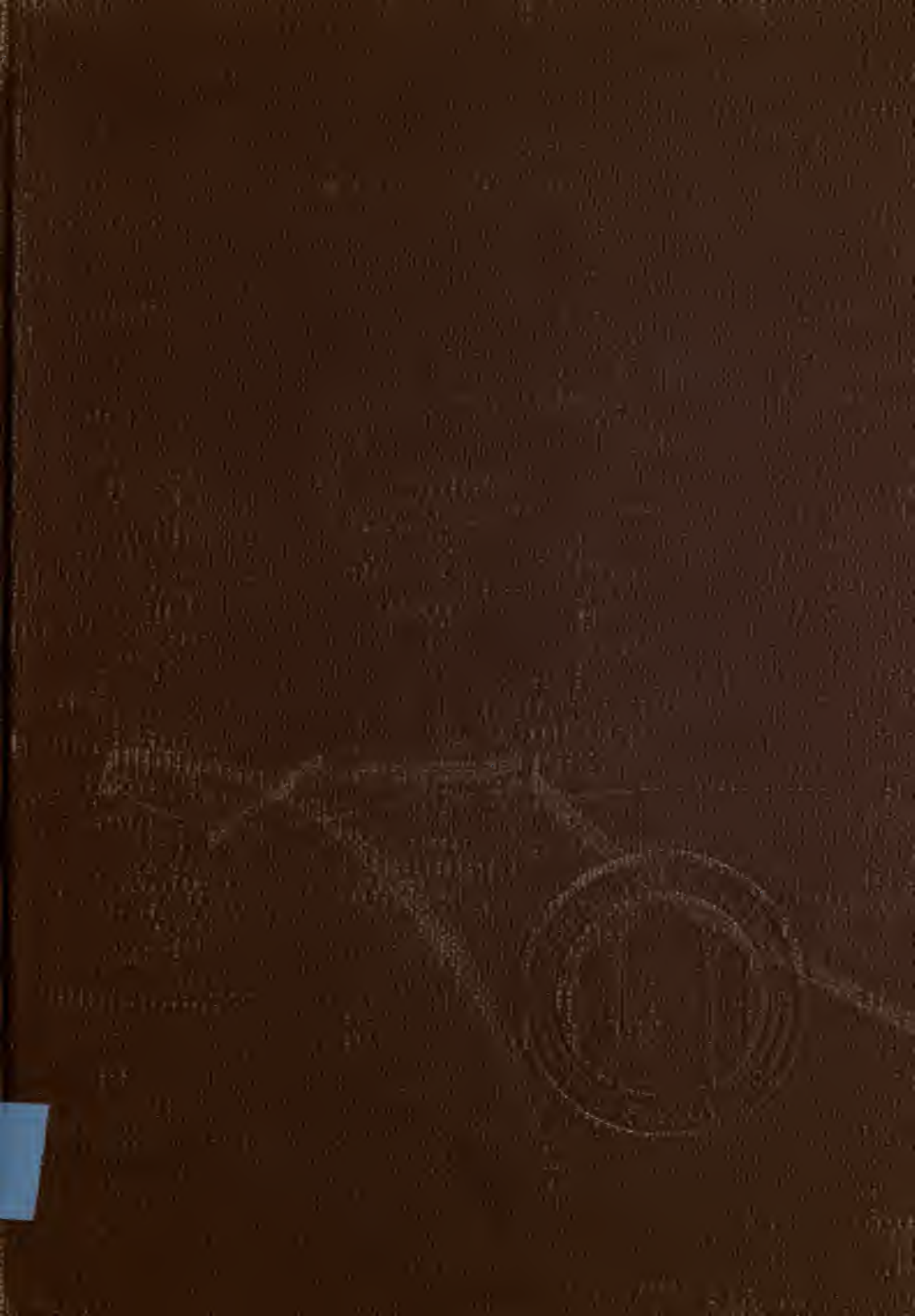

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Let this Book, Intituled, *The History of the* ROYAL SOCIETY *of* LONDON, *for the improving of* Natural Knowledge, *be Printed.*

WILLIAM MORRICE.

# THE HISTORY OF THE ROYAL SOCIETY OF LONDON,

For the Improving of

## NATURAL KNOWLEDGE.

By *THO. SPRAT*, D. D. late Lord Bishop of ROCHESTER.

The FOURTH EDITION.

*LONDON:*

Printed for J. KNAPTON, J. WALTHOE, D. MIDWINTER, J. TONSON, A. BETTESWORTH and C. HITCH, R. ROBINSON, F. CLAY, B. MOTTE, A. WARD, D. BROWN, and T. LONGMAN.

M DCC XXXIV.

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ATLOS ANGELES

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1734

TO THE

# KING.

SIR,

OF *all the Kings of* Europe, *Your Majesty was the first, who confirm'd this noble Design of* Experiments, *by Your own Example, and by a publick Establishment. An* Enterprize *equal to the most renown'd Actions of the best* Princes.

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Princes. *For, to increaſe the Powers of all Mankind, and to free them from the Bondage of Errors, is greater Glory than to enlarge* Empire, *or to put Chains on the Necks of conquer'd* Nations.

*What Reverence all* Antiquity *had for the* Authors *of* natural Diſcoveries, *is evident by the diviner Sort of Honour they conferr'd on them. Their Founders of* philoſophical Opinions *were only admir'd by their own* Sects: *Their* valiant Men *and* Generals *did ſeldom riſe higher than to* Demy-Gods *and* Heroes: *But the* Gods *they worſhipped with* Temples *and* Altars, *were thoſe who inſtructed the World to* plow, *to* ſow, *to* plant, *to* ſpin, *to* build Houſes, *and to find out* new Countries. *This Zeal indeed, by which they expreſs'd their Grati-*

*Gratitude to ſuch Benefactors, degenerated into Superſtition; yet has it taught us, that a higher Degree of Reputation is due to* Diſcoverers, *than to the* Teachers *of* ſpeculative Doctrines, *nay even to* Conquerors *themſelves.*

*Nor has the* true God *himſelf omitted to ſhew his Value of* vulgar Arts. *In the whole* Hiſtory *of the firſt* Monarchs *of the World, from* Adam *to* Noah, *there is no mention of their* Wars, *or their* Victories: *All that is recorded is this, they liv'd ſo many Years, and taught their* Poſterity *to keep* Sheep, *to till the* Ground, *to plant* Vineyards, *to dwell in* Tents, *to build* Cities, *to play on the* Harp *and* Organs, *and to work in* Braſs *and* Iron. *And if they deſerv'd a* ſacred Remembrance, *for one* natural

tural *or* mechanical Invention, *Your* Majeſty *will certainly obtain* immortal Fame, *for having eſtabliſhed a perpetual Succeſſion of* Inventors.

I am,

May it pleaſe your Majeſty,

Your Majeſty's moſt humble,

and moſt obedient

Subject and Servant,

THO. SPRAT.

# ROYAL SOCIETY.

I.

*PHILOSOPHY, the great and only Heir*
*Of all that human Knowledge which has bin*
*Unforfeited by Man's rebellious Sin,*
*Though full of Years He do appear,*
*(Philoſophy, I ſay, and call it, He,*
*For whatſoe'er the Painter's Fancy be,*
*It a male Virtue ſeems to me)*
*Has ſtill been kept in Non-age till of late,*
*Nor manag'd or enjoy'd his vaſt Eſtate:*
*Three or four thouſand Years one would have thought,*
*To Ripeneſs and Perfection might have brought*
*A Science ſo well bred and nurſt,*
*And of ſuch hopeful Parts too at the firſt.*
*But, oh! the Guardians and the Tutors then,*
*(Some negligent and ſome ambitious Men)*
*Would ne'er conſent to ſet him free,*
*Or his own natural Powers to let him ſee,*
*Leſt that ſhould put an end to their Authoritie.*

II.

*That his own Buſineſs he might quite forget,*
*They' amus'd him with the Sports of wanton Wit,*
*With the Deſerts of Poetry they fed him,*
*Inſtead of ſolid Meats t'encreaſe his Force;*
*Inſtead of vigorous Exerciſe, they led him*
*Into the pleaſant Labyrinths of ever-freſh Diſcourſe:*
*Inſtead of carrying him to ſee*
*The Riches which do hoarded for him lye*

*In Nature's endleſs Treaſury,*
*They choſe his Eye to entertain*
*(His curious but not covetous Eye)*
*With painted Scenes, and Pageants of the Brain.*
*Some few exalted Spirits this latter Age has ſhown,*
*That labour'd to aſſert the Liberty*
*(From Guardians who were now Uſurpers grown)*
*Of this old* Minor *ſtill, captiv'd Philoſophy;*
*But 'twas Rebellion call'd to fight*
*For ſuch a long oppreſſed Right.*
Bacon *at laſt, a mighty Man, aroſe,*
*Whom a wiſe King and Nature choſe*
*Lord Chancellor of both their Laws,*
*And boldly undertook the injur'd Pupil's Cauſe.*

III.

*Authority, which did a Body boaſt,*
*Though 'twas but Air condens'd, and ſtalk'd about,*
*Like ſome old Giant's more gigantic Ghoſt,*
*To terrify the learned Rout*
*With the plain Magic of true Reaſon's Light,*
*He chac'd out of our Sight,*
*Nor ſuffer'd living Men to be miſled*
*By the vain Shadows of the Dead: (fled;*
*To Graves, from whence it roſe, the conquer'd Phantome*
*He broke that monſtrous God which ſtood*
*In midſt of th' Orchard, and the whole did claim,*
*Which with a uſeleſs Scythe of Wood,*
*And ſomething elſe not worth a Name,*
*(Both vaſt for Shew, yet neither fit*
*Or to defend, or to beget;*
*Ridiculous and ſenſeleſs Terrors!) made*
*Children and ſuperſtitious Men afraid.*
*The Orchard's open now, and free;*
Bacon *has broke that Scare-crow Deity;*

*Come, enter, all that will,*
*Behold the ripened Fruit, come gather now your Fill.*
*Yet ſtill, methinks, we fain would be*
*Catching at the forbidden Tree,*
*We would be like the Deity.*
*When Truth and Falſhood, Good and Evil, we*
*Without the Senſes Aid within our ſelves would ſee;*
*For 'tis God only who can find*
*All Nature in his Mind.*

IV.

*From Words, which are but Pictures of the Thought,*
*(Though we our Thoughts from them perverſly drew)*
*To Things, the Mind's right Object, he it brought:*
*Like fooliſh Birds to painted Grapes we flew;*
*He ſought and gather'd for our Uſe the true;*
*And when on Heaps the choſen Bunches lay,*
*He preſs'd them wiſely the mechanic Way,*
*Till all their Juice did in one Veſſel join,*
*Ferment into a Nouriſhment Divine,*
*The thirſty Soul's refreſhing Wine.*
*Who to the Life an exact Piece would make,*
*Muſt not from others Work a Copy take;*
*No, not from* Rubens *or* Vandike;
*Much leſs content himſelf to make it like*
*Th' Ideas and the Images which lye*
*In his own Fancy, or his Memory:*
*No, he before his Sight muſt place,*
*The natural and living Face;*
*The real Object muſt command,*
*Each Judgment of his Eye, and Motion of his Hand.*

V.

*From theſe and all long Errors of the Way,*
*In which our wandring Predeceſſors went,*
*And like th' old* Hebrews *many Years did ſtray,*



*In*

*In Desarts but of small Extent,*
Bacon, *like* Moses, *led us forth at last,*
*The barren Wilderness he past,*
*Did on the very Border stand*
*Of the blest promis'd Land,*
*And from the Mountain's Top of his exalted Wit,*
*Saw it himself, and shew'd us it.*
*But Life did never to one Man allow*
*Time to discover Words, and conquer too;*
*Nor can so short a Line sufficient be*
*To fathom the vast Depth of Nature's Sea:*
*The Work he did we ought t' admire,*
*And were unjust if we should more require*
*From his few Years, divided 'twixt th' Excess*
*Of low Affliction and high Happiness:*
*For who on Things remote can fix his Sight,*
*That's always in a Triumph, or a Fight?*

VI.

*From you, great Champions, we expect to get*
*These spacious Countries but discover'd yet;*
*Countries where yet instead of Nature, we*
*Her Images and Idols worship'd see:*
*These large and wealthy Regions to subdue,*
*Though Learning has whole Armies at Command,*
*Quarter'd about in every Land,*
*A better Troop she ne'er together drew.*
*Methinks, like* Gideon's *little Band,*
*God with Design has pick'd out you,*
*To do these noble Wonders by a few:*
*When the whole Host he saw, they are (said he)*
*Too many to o'ercome for me;*
*And now he chuses out his Men,*
*Much in the way that he did then:*
*Not those many whom he found*
*Idly extended on the Ground,*

*To drink with their dejected Head*
*The Stream just so as by their Mouths it fled:*
*No, but those few who took the Waters up,*
*And made of their laborious Hands the Cup.*

VII.

*Thus you prepar'd, and in the glorious Fight*
*Their wondrous Pattern too you take:*
*Their old and empty Pitchers first they brake,*
*And with their Hands then lifted up the Light.*
*Iö! Sound too the Trumpets here!*
*Already your victorious Lights appear;*
*New Scenes of Heaven already we espy,*
*And Crowds of golden Worlds on high;*
*Which from the spacious Plains of Earth and Sea,*
*Could never yet discover'd be*
*By Sailors or* Chaldæans *watchful Eye.*
*Nature's great Works no Distance can obscure,*
*No Smalness her near Objects can secure.*
*You've taught the curious Sight to press*
*Into the privatest Recess*
*Of her imperceptible Littleness.*
*She with much stranger Art than his who put*
*All th'* Iliads *in a Nut,*
*The numerous Work of Life does into Atoms shut.*
*You've learn'd to read the smallest Hand,*
*And well begun her deepest Sense to understand.*

VIII.

*Mischief and true Dishonour fall on those*
*Who would to Laughter or to Scorn expose*
*So virtuous and so noble a Design,*
*So human for its Use, for Knowledge so Divine.*
*The Things which these proud Men despise, and call*
*Impertinent, and vain, and small,*

*Thoſe ſmalleſt Things of Nature let me know,*
*Rather than all their greateſt Actions do.*
*Whoever would depoſed Truth advance*
*Into the Throne uſurp'd from it,*
*Muſt feel at firſt the Blows of Ignorance,*
*And the ſharp Points of envious Wit,*
*So when by various Turns of the celeſtial Dance,*
*In many thouſand Years*
*A Star ſo long unknown, appears,*
*Though Heaven it ſelf more beauteous by it grow,*
*It troubles and alarms the World below,*
*Does to the Wiſe a Star to Fools a Meteor ſhow.*

IX.

*With Courage and Succeſs you the bold Work begin;*
*Your Cradle has not idle been:*
*None e'er but* Hercules *and you could be*
*At five Years Age worthy a Hiſtory.*
*And ne'er did Fortune better yet*
*Th' Hiſtorian to the Story fit:*
*As you from all old Errors free*
*And purge the Body of Philoſophy;*
*So from all modern Follies He*
*Has vindicated Eloquence and Wit.*
*His candid Style like a clean Stream does ſlide,*
*And his bright Fancy all the way*
*Does like the Sun-ſhine in it play;*
*It does like* Thames, *the beſt of Rivers, glide,*
*Where the God does not rudely overturn,*
*But gently pour the cryſtal Urn,*
*And with judicious Hand does the whole Current guide,*
*H' as all the Beauties Nature can impart,*
*And all the comely Dreſs without the Paint of Art.*

A. COWLEY.

AN

# ADVERTISEMENT

TO THE

# READER.

*THE Reader is entreated to take Notice, that much of this Diſcourſe was written and printed above two Years before the reſt: For this Cauſe, in the firſt and ſecond Books, he may chance to find ſome Expreſſions, that by reaſon of the difference of Time may ſeem not well to agree with the laſt: But thoſe having paſs'd the Preſs ſo long ago, were out of my Power of changing them; and therefore I will refer it to his Kindneſs to do it for me.*

*I muſt alſo acquaint him, that in the Title of my Book I have taken a Liberty, which may be liable to Exception: I have call'd it a* Hiſtory of the Royal Society; *whereas the firſt Part wholly treats of the State of the* Ancient Philoſophy; *and the third chiefly contains a Defence and Recommendation of* experimental Knowledge *in general: So that*

*that it is only the ſecond Book that peculiarly deſcribes their Undertaking. But for my Excuſe I may alledge the Example of many of the* Ancients, *who have often from the principal Part of their Works given Title to all the reſt: In their Imitation, though this Book does treat of many Subjects that are not Hiſtorical, yet I have preſum'd to name the whole a* Hiſtory, *becauſe that was the main End of my Deſign.*

*The Style perhaps in which it is written, is larger and more contentious than becomes that Purity and Shortneſs which are the chief Beauties of hiſtorical Writings: But the Blame of this ought not ſo much to be laid upon me, as upon the Detractors of ſo noble an Inſtitution: For their Objections and Cavils againſt it, did make it neceſſary for me to write of it, not altogether in the way of a* plain Hiſtory, *but ſometimes of an* Apology.

THE

# THE HISTORY OF THE *Institution, Design,* and *Progress,* OF THE ROYAL SOCIETY OF *LONDON,*

*For the Advancement of experimental* Philosophy.

## *The* First Part.

Sect. I. *The Preface, and Design of this Discourse.*

I Shall here present to the World, an Account of the *first Institution* of the *Royal Society*; and of the *Progress*, which they have already made: In hope, that this learned and inquisitive Age, will either think their Indeavours worthy of its *Assistance*; or else will be thereby provok'd, to attempt some *greater Enterprize* (if any such can be found out) for the

Benefit of human Life, by the Advancement of *Real Knowledge*.

Perhaps this Task, which I have propos'd to my ſelf, will incur the Cenſure of many judicious Men, who may think it an over-haſty and preſumptuous Attempt; and may object to me, that the *Hiſtory* of an Aſſembly which begins with ſo great Expectations, ought not to have been made publick ſo ſoon; till we could have produced very many conſiderable *Experiments*, which they had try'd, and ſo have given undeniable *Proofs* of the Uſefulneſs of their Undertaking.

In anſwer to this, I can plead for my ſelf, that what I am here to ſay, will be far from preventing the Labours of others in adorning ſo worthy a Subject; and is *premis'd* upon no other account, than as the nobleſt Buildings are firſt wont to be repreſented in a few *Shadows* or ſmall *Models*; which are not intended to be equal to the chief Structure it ſelf, but only to ſhew in little, by what *Materials*, with what *Charge*, and by how *many Hands*, that is afterwards to be rais'd. Although, therefore, I come to the Performance of this Work, with much leſs *Deliberation*, and *Ability*, than the *Weightineſs* of it requires; yet I truſt, that the *Greatneſs* of the *Deſign* it ſelf, on which I am to ſpeak, and the *Zeal* which I have for the *Honour* of our *Nation*, which have been the chief Reaſons that have mov'd me to this Confidence of Writing, will ſerve to make ſomething for my *Excuſe*. For what greater matter can any Man deſire, about which to employ his Thoughts, than the Beginnings of an *Illuſtrious Company*, which has already laid ſuch excellent Foundations of ſo much Good to *Mankind?*

Or, what can be more delightful for an *Engliſh* Man to conſider, than that notwithſtanding all the late Miſeries of his Country, it has been able in a ſhort Time ſo well to recover it ſelf, as not only to attain to the Perfection of its *former* Civility, and Learning, but alſo to ſet on foot a *new* Way of Improvement of Arts, as *great* and as *beneficial* (to ſay no more) as any the wittieſt or the happieſt Age has ever invented?

But beſides this, I can alſo add, in my Defence, that though the *Society*, of which I am to write, is not yet four Years old, and has been of neceſſity hitherto chiefly taken up, about *preparatory Affairs*; yet even in this Time, they have not wholly neglected their *principal End*, but have had Succeſs, in the Trial of many remarkable Things; of which I doubt not, but I ſhall be able, as I paſs along, to give Inſtances enough to ſatisfy the Curioſity of all *ſober Inquirers* into Truth. And in ſhort, if for no other End, yet certainly for this, a Relation of their firſt Original ought to be expos'd to the View of Men: That by laying down, on what courſe of Diſcovery they intend to proceed, the *Gentlemen of the Society* may be more ſolemnly engag'd, to *proſecute* the ſame. For now they will not be able, handſomely to draw back, and to forſake ſuch honourable Intentions; when the World ſhall have taken notice, that ſo many prudent Men have gone ſo far, in a Buſineſs of this univerſal Importance, and have given ſuch undoubted *Pledges* of many admirable Inventions to follow.

Sect. II. *The Diviſion of the Diſcourſe.*

I ſhall therefore divide my Diſcourſe into theſe three general Heads.

The *first* shall give a short View of the *Ancient* and *Modern* Philosophy; and of the most famous Attempts, that have been made for its *Advancement:* That by observing wherein others have *excell'd*, and wherein they have been thought to *fail*, we may the better shew, what is to be expected from these new Undertakers; and what mov'd them, to enter upon a Way of Inquiry, different from that, on which the former have proceeded.

The *second* shall consist of the *Narrative* it self: And out of their *Registers*, and *Journals*, which I have been permitted to peruse, shall relate the first Occasions of their Meetings, the Incouragement, and Patronage, which they have receiv'd; their *Patent*, their *Statutes*, the whole Order and Scheme of their *Design*, and the *Manner* of their Proceedings.

The *third* shall try, to assert the *Advantage* and *Innocence* of this Work, in Respect of all *Professions*, and especially of *Religion*; and how proper, above others, it is, for the present Temper of the *Age* wherein we live.

On the *first* and *last* of these Particulars, it is not needful that I should long insist: Because several *great Men* have already so much prevented me about them; that there is hardly any thing can be spoken, in which I shall not almost tread in their very *Footsteps*. But yet it is requisite, that something be here said to that purpose, though it be only in *Repetition:* Because I perceive, that there is still much prejudice remaining on many Men's Minds, towards any *new* Discoveries in *natural* Things. This I shall try to remove, not that I imagine, that those Reasons can have any great effect

fect in my *weak Hands*, which were not able fully to prevail, when they were inforc'd by the Eloquence of thoſe *excellent Men* who have gone before me in this Argument: But I rather truſt to the inclination of the *Age* it ſelf, wherein I write; which (if I miſtake not) is far more prepar'd to be perſuaded to promote ſuch Studies, than any other Time that has gone before us.

Sect. III. *The Philoſophy of the East.*

And firſt, let us obſerve the Practice of the beſt, and the civileſt Nations, amongſt the *Ancients*; and a little trace out the Courſe which they follow'd, to enrich their Countries, by the introducing of *Foreign* Arts, or a ſearching into *New*.

It is evident, from the univerſal Teſtimony of *Hiſtory*, that all Learning and Civility were deriv'd down to us from the *Eaſtern* Parts of the World. There it was, that Mankind aroſe: and there they firſt diſcover'd the Ways of Living, with Safety, Convenience and Delight. It is but juſt, that we ſhould attribute the original of *Aſtronomy*, *Geometry*, *Government*, and many Sorts of Manufactures, which we now enjoy, to the *Aſſyrians*, the *Chaldeans*, and *Egyptians*. And as to them we owe the *Invention*; ſo from them proceeded the firſt *Corruption* of Knowledge. It was the Cuſtom of their wiſe Men, to wrap up their Obſervations on Nature, and the Manners of Men, in the dark Shadows of *Hieroglyphicks*; and to conceal them, as ſacred *Myſteries*, from the Apprehenſions of the Vulgar. This was a ſure Way to beget a Reverence in the People's Hearts towards *themſelves*: But not to advance the true Philoſophy of *Nature*. That ſtands not in need of ſuch Artifices to uphold its credit: But is then moſt likely

to

to thrive, when the Minds, and Labours of Men of all Conditions, are join'd to promote it, and when it becomes the Care of united Nations.

Into the *East*, the first inquisitive Men amongst the *Grecians* travelled: By what they observed there, they ripened their own imperfect Conceptions, and so returned to teach them at Home. And that they might the better insinuate their Opinions into their Hearers Minds, they set them off with the Mixture of *Fables* and the Ornaments of *Fancy*. Hence it came to pass, that the first Masters of Knowledge amongst them, were as well *Poets*, as *Philosophers*; for *Orpheus*, *Linus*, *Musæus*, and *Homer*, first softned Men's natural Rudeness; and by the Charms of their Numbers, allur'd them to be instructed by the severer Doctrines of *Solon*, *Thales*, and *Pythagoras*. This was a Course, that was useful at first, when Men were to be delightfully deceiv'd to their own Good: But perhaps it left some ill Influence on the whole Philosophy of their Successors; and gave the *Grecians* occasion ever after of exercising their Wit, and their Imagination, about the Works of Nature, more than was consistent with a sincere Inquiry into them.

Sect. IV. *The Philosophy of Greece.*

When the fabulous Age was past, *Philosophy* took a little more Courage; and ventured more to rely upon its own Strength, without the Assistance of *Poetry*. Now they began to gather into Assemblies, and to increase their Interest: and according to the different Temper of the *Grecians*, from the *Eastern* Nations, so were their Arts propagated in a different Way from theirs. The *Greeks*, being of a vigorous, and active Humour, establish'd their Philo-

sophy

ſophy in the *Walks*, and *Porches*, and *Gardens*, and ſuch publick places about their Cities; whereas the graver and more reſerv'd *Ægyptians*, had confin'd it to their *Temples*.

In *Greece*, the moſt conſiderable (and indeed almoſt the only ſucceſsful) Trials, that were made in this way, were at *Athens*; the Wit of whoſe Inhabitants, was, 'tis true, admirably fit for the reducing of Philoſophy into *Method*, and for the adorning of it with the nobleſt Words, when once it had been before compleated in its Subſtance: But yet their Genius was not ſo well made, for the undergoing the firſt *Drudgery* and *Burden* of *Obſervation* which is needful for the *Beginning* of ſo difficult a Work. This will appear, if we remember, that they were the Maſters of the Arts of *Speaking* to all their Neighbours; and ſo might well be inclin'd, rather to chuſe ſuch Opinions of Nature, which they might moſt elegantly expreſs, than ſuch, which were more uſeful, but could not ſo well be illuſtrated by the Ornaments of Speech. Beſides this, their *City* was the general *School*, and Seat of *Education*; and therefore the Epitomes of Knowledge beſt ſerved their turn, to make their Scholars, in a ſhort time, finiſh the courſe of their Studies, and go home ſatisfied with a Belief of their own Proficience, and their Teacher's Wiſdom. They were alſo commonly (as moſt of the other *Grecians*) Men of hot, earneſt, and haſty Minds; and ſo lov'd rather to make *ſudden* Concluſions, and to convince their Hearers by Argument, than to *delay* long, before they fixt their Judgments; or to attend with ſufficient Patience the Labour of Experiments. But to ſay no more, they had but a *narrow Territory*; and the condition

on of thoſe times, would not allow a very large Commerce with foreign Nations: they were much exercis'd in the civil Affairs of their Country: they had almoſt a perpetual War at home, or abroad: which Kinds of buſie and active Life breed Men up indeed for great Employments: but not ſo well for the diligent, private, and ſevere Examination of thoſe little and almoſt infinite Curioſities, on which the true Philoſophy muſt be founded.

Sect. V. *The Original of the Philoſophical Sects.*

In that City therefore, the Knowledge of *Nature* had its Original, before either that of *Diſcourſe*, or of *human Actions*; but it was quickly forc'd to give way to them both: For it was not yet come to a ſufficient Ripeneſs, in the time of *Socrates*; and he, by the Authority of his admirable Wit, made all parts of Philoſophy to be taken off from a Condition of encreaſing much farther, that they might be immediately ſerviceable to the Affairs of Men, and the Uſes of Life. He was one of the firſt Men, that began to draw into ſome Order, the confus'd and obſcure Imaginations of thoſe that went before him: and to make way for the compoſing of Arts, out of their ſcattered Obſervations. All theſe various Subjects, the Vaſtneſs of his Soul comprehended in his *caſual Diſputations*: but after his Death they were divided amongſt his Followers, according to their ſeveral Inclinations. From him moſt of the ſucceeding *Sects* deſcended: and though every one of them had its different Principles and Rendezvouſes; yet they all laid claim to this one common Title of being *his Diſciples*. By this means, there was a moſt ſpecious Appearance of the Increaſe of Learning: all places were fill'd with Philoſophical

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Diſputes: Controverſies were rais'd: Faſhions were made: Many Subtilities of confuting, and defending, were invented: But ſo inſtead of joining all their Strength to overcome the Secrets of Nature (all which would have been little enough, though ever ſo wiſely manag'd) they only did that, which has undone many ſuch great Attempts; before they had yet fully conquer'd her, they fell into an open Diſſenſion, to which of them her Spoils did belong.

'Tis true, at the ſame time, ſome few Men did continue an earneſt, and laborious Purſuit, after *natural Cauſes, and Effects*; and took that Courſe, which, if it had met with as much Encouragement, as the others had, would without queſtion have produc'd extraordinary Things. But theſe Philoſophers digging deep out of the ſight of Men; and ſtudying more, how to *conceive* Things aright, than how to *ſet off*, and perſuade their Conceptions, to others; were quickly almoſt quite overwhelm'd, by the more plauſible and talkative Sects.

Sect. VI. *The Philoſophy amongſt the Romans.*

This was the ſucceſs of that famous Age of the *Grecian* Learning, in reſpect of natural Knowledge. They ſtay'd not for an Information ſufficient for ſuch a noble Enterprize: They would not ſuffer their Poſterity to have any Share with them, in the Honour of performing it: But too ſuddenly, for preſent Uſe, they clap'd up an entire Building of Sciences: And therefore it is not to be wonder'd, if the *haſty Fabrick*, which they rais'd, did not conſiſt of the beſt Materials.

But at laſt with their Empire, their Arts alſo were tranſported to *Rome*: The great Spirit of their Lawgivers, and Philoſophers, in Courſe of Time, dege-

nerating into Rhetoricians, and wandring Teachers of the Opinions of their private Sects. Amongst the *Romans*, the Studies of Nature met with little, or no Entertainment. They scarce ever dream'd of any other Way of Philosophy, than only just reducing into new Method, and eloquently translating into their own Language, the Doctrines, which they had receiv'd from the *Greeks*. And it was a long time too, before even that could obtain any Countenance amongst them. For, in the first warlike and busy Ages of that State, they only apply'd themselves to a Severity of moral Virtue; endeavour'd after no other Skill, than that of the Customs, and Laws of their Country, the Ceremonies of their Religion, and the Arts of Government: Esteeming every Thing that came out of *Greece*, as an out-landish Fashion, which would corrupt the Manners of their Youth; and allure them, from that Strictness of Discipline, and Integrity of Life, by which they had inlarg'd the Bounds of their Common-wealth: 'Till at length their Power being increas'd, and their Minds a little softned by the Greatness of their Commands, and having tasted of the Pleasures of the East; they were content too, by degrees, to admit their Philosophy. And yet all the Use, that they made of it at last, was only, either that they might thereby make their Speech more plentiful; or else, that when they were at leisure from civil Affairs, they might have that as a Companion, and Comfort of their Retirements.

Sect. VII. *The Philosophy of the Primitive Church.*

This was the Condition of Philosophy, when the Christian Religion came into the World. That maintain'd it self in its first Age, by the Innocence, and Miracles,

Miracles, and Sufferings of its Founder, and his Apoſtles. But after their Deaths, when Chriſtianity began to ſpread into the fartheſt Nations, and when the Power of working Wonders had ceas'd: It was thought neceſſary for its Increaſe, that its Profeſſors ſhould be able to defend it, againſt the Subtilities of the Heathens; by thoſe ſame ways of Arguing, which were then in uſe, among the Heathen Philoſophers. It was therefore on this Account, that the Fathers, and chief Doctors of our Church, apply'd themſelves to the Peripatetick, and Platonick Sects; but chiefly to the Platonick: Becauſe that ſeem'd to ſpeak plainer about the Divine Nature; and alſo, becauſe the Sweetneſs, and Powerfulneſs of *Plato*'s Writings, did ſerve as well to make them popular Speakers, as Diſputers. Having thus provided themſelves againſt their Adverſaries, they eaſily got the Victory over them: And though the idolatrous Gentiles had kept the Inſtruments of diſputing, in their own Hands, ſo many hundred Years; yet they ſoon convinced them of the Ridiculouſneſs of their Worſhip, and the Purity, and the Reaſonableneſs of ours.

But now the Chriſtians having had ſo good Succeſs, againſt the Religions of the Heathens, by their own Weapons; inſtead of laying them down when they had done, unfortunately fell to manage them one againſt another. So many ſubtle Brains having been ſet on work, and warm'd againſt a foreign Enemy: When that was over, and they had nothing elſe to do (like an Army that returns victorious, and is not preſently disbanded) they began to ſpoil, and quarrel amongſt themſelves. Hence that Religion, which at firſt appear'd ſo innocent, and peaceable,

and fitted for the Benefit of human Society; which conſiſted in the plain, and direct Rules, of good Life, and Charity, and the Belief in a Redemption by one Saviour, was miſerably divided into a thouſand intricate Queſtions, which neither advance true Piety, nor good Manners. Hence aroſe all the Hereſies of thoſe times. Againſt theſe, beſides the force of Diſputation, the Church obtain'd the Arm of the Civil Magiſtrate: and ſo at laſt by the help of many General Councils, got them extinguiſh'd; if I may ſay they were extinguiſh'd, ſeeing in this Age wherein we live, we have ſeen moſt of them unhappily revived. But ſtill by this means, there was no Knowledge in Requeſt, but the Diſputative Philoſophy. For while things were in this poſture, and ſo many great Wits ingag'd in the heats of Controverſy: it was not to be expected, that they ſhould look out for farther aſſiſtance, than the Arts, which were already prepar'd; or that they ſhould make any conſiderable Indeavours, about new Inventions, and the tedious Trial of Experiments. Nor can we much blame them for it: ſeeing in a time of War, every Man will rather ſnatch up that Armour which he finds ready made, than ſtay till Men go to the Mine, and dig out new Ore, and refine, and harden it a better way; in hope to have his Weapons of a ſtronger, and nobler Metal at laſt.

Nor was that Age unfit for ſuch an Enterprize, only on the Account of theſe Wars of the Tongue: But alſo by Reaſon of the miſerable Diſtempers of the civil Affairs of the World, about that time: which were chiefly occaſion'd by the *Roman* Army's uſurping the Right of chuſing Emperors, and by the Invaſions of Barbarous Nations, which overwhelm'd the greateſt Part of *Europe*. Amidſt theſe Diſtractions,

it

it was impoſſible for any thing of this Nature to have proſper'd: And in ſo vaſt an Inundation of Ignorance, which carry'd away with it the very grown and aged Trees themſelves (thoſe Parts of Learning which had taken Root, ſo many Generations paſt) it would have been in vain, to have committed any new Plants to the Ground. Such Studies as theſe, as they muſt receive Encouragement from the Sovereign Authority, ſo they muſt come up in a peaceful Time, when Men's Minds are at Eaſe, and their Imaginations not diſturb'd, with the Cares of preſerving their Lives, and Fortunes.

Sect. VIII. *The Philoſophy under the Church of Rome.*

To go on therefore with the Matter of Fact: Having left that diſmal bloody Age we come into a Courſe of Time, which was indeed far quieter: But it was like the Quiet of the Night, which is dark withal. The Biſhops of *Rome* taking the Opportunity of the Decay of the *Roman* Empire, had wreſted from it ſo many Privileges, as did at laſt wholly deſtroy it: And while it was gaſping for Life, forc'd it to make what Will and Teſtament they pleas'd. Being thus eſtabliſh'd, and making *Rome*, whoſe Name was ſtill venerable, the Seat of their Dominion, they ſoon obtain'd a Supremacy over the Weſtern World. Under them for a long Space together Men lay in a profound Sleep. Of the univerſal Ignorance of thoſe Times, let it ſuffice to take the Teſtimony of *William* of *Malmsbury*, one of our ancient *Engliſh* Hiſtorians, who ſays, that even amongſt the Prieſts themſelves, he was a Miracle that could underſtand *Latin*. Thus they continued; till at laſt, that Church adopted, and cheriſh'd ſome of the Peripatetic Opinions, which the moſt ingenious of the Monks,

Monks, in their ſolitary and idle Courſe of Life, had lighted upon. This Sect was excellently well made for their Turn. For by hovering ſo much, in general Terms, and Notions, it amus'd Men's Minds, in Things that had not much Difficulty: And ſo the Laity being kept blind, were forc'd in all Things to depend on the Lips of the *Roman Clergy*. From that time even down to the *Reformation*, the *Gentlemen* of all theſe Countries, imploying themſelves, chiefly in Arms and Adventures abroad: And the Books of the *Ancients*, being either deſtroy'd by the *Goths*, and *Vandals*; or thoſe which eſcaped their Fury, lying cover'd with Duſt in the Libraries of *Monaſteries*; few or none regarded any of the Arts of Wit, and Reaſon, beſides the *Church-men*.

This, I will take the Boldneſs to ſay, muſt needs be very injurious to the Increaſe of *general Learning*. For though I ſhall juſtly affirm to the Honour of that *ſacred Profeſſion*, that all Knowledge has been more ſearch'd into, and promoted by *them*, than by any other *Order* of Men, even from the *Egyptians* Times, (whoſe *Prieſts* in good part invented, or at leaſt preſerv'd, the Learning of the *Eaſt*) down to our preſent Age: Yet I muſt alſo add, that whenever all the ſtudious Spirits of a Nation, have been reduc'd within the Temple's Walls, that Time is naturally liable to this Danger, of having its Genius more intent, on the different Opinions in *Religion*, and the Rites of Worſhip, than on the Increaſe of any other *Science*. Of this I ſhall give two Inſtances: one, from the *Ancients*, the other, from *our ſelves*.

It is manifeſt, that amongſt the *Jews*, all the Men of Letters ſtill apply'd themſelves to the underſtanding of their *Law*: that being the publick Way

of Preferment, to the higheſt Places of Judicature and Authority in the State. For that many Fraternities were erected, and (as I may call them) *Judaical Monaſteries* conſtituted. Hence came all the Interpretations on the Writings of their *great Law-giver*: Which at laſt grew ſo numerous, and various amongſt themſelves, that *Chriſt*, when he came, could hardly find any thing of *Moſes his Mind*, in all they had writ: But performed more himſelf towards the Explanation of the *Law* in *two Chapters*, than they had done in all their infinite Volumes. But while they were ſo exceſſively buſy, about ſuch ſorts of Contemplations, the other Parts of Learning were neglected: Little or no Footſteps of Philoſophy remaining amongſt them, except only the Memory of that *Hiſtory of Plants*, which was not written by any of *Aaron*'s Family, but by their *wiſeſt King*.

Sect. IX. *The Philoſophy of the School-men.*

But my other Inſtance comes nearer home, and it is of the *School-men*. Whoſe Works when I conſider, it puts into my Thoughts, how far more importantly a good Method of Thinking, and a right Courſe of apprehending Things, does contribute towards the attaining of Perfection in true Knowledge, than the ſtrongeſt, and moſt vigorous Wit in the World, can do without them. It cannot without Injuſtice be deny'd, that they were Men of extraordinary Strength of Mind: They had a great Quickneſs of Imagination, and Subtility of diſtinguiſhing: They very well underſtood the Conſequence of Propoſitions: Their natural Endowments were excellent: Their Induſtry commendable: But they lighted on a wrong Path at firſt, and wanted Matter to contrive: And ſo, like the *Indians*, only expreſs'd a wonderful Artifice,

Artifice, in the ordering of the ſame Feathers into a thouſand Varieties of Figures. I will not inſiſt long on the Barbarouſneſs of their Stile; though that too muſt juſtly be cenſur'd: For all the *ancient Philoſophers*, though they labour'd not to be full and adorn'd in their Speech, yet they always ſtrove to be eaſy, natural, and unaffected. *Plato* was allow'd by all to be the chief Maſter of *Speaking*, as well as of *Thinking*. And even *Ariſtotle* himſelf, whom alone theſe Men ador'd, however he has been ſince us'd by his *Commentators*, was ſo careful about his Words, that he was eſteem'd one of the pureſt, and moſt polite Writers of his Time. But the want of good Language, not being the *School-men*'s worſt defect, I ſhall paſs it over, and rather ſtop a little, to examine the *Matter* it ſelf, and *Order* in which they proceeded.

The *Subjects* about which they were moſt converſant, were either ſome of thoſe *Arts*, which *Ariſtotle* had drawn into Method, or the more ſpeculative Parts of our *Divinity*. Theſe they commonly handled after this Faſhion. They began with ſome general Definitions of the Things themſelves, according to their univerſal Natures, then divided them into their Parts, and drew them out into ſeveral Propoſitions, which they laid down as Problems: Theſe they controverted on both ſides; and by many Niceties of Arguments, and Citations of Authorities, confuted their Adverſaries, and ſtrengthned their own Dictates. But though this notional War had been carry'd on with far more Care, and Calmneſs amongſt them, than it was: Yet it was never able to do any great Good towards the Enlargement of Knowledge; becauſe it rely'd on *general Terms*,

which had not much Foundation in *Nature*, and also because they took no other Course, but that of *Disputing*.

That this insisting altogether on establish'd *Axioms*, is not the most useful Way, is not only clear in such airy Conceptions, which they manag'd; but also in those Things, which lye before every Man's observation, which belong to the Life and Passions, and Manners of Men; which, one would think, might be sooner reduc'd into standing Rules. As for example; to make a prudent Man in the Affairs of State, it is not enough to be well vers'd in all the Conclusions, which all the *Politicians* in the World have devis'd, or to be expert in the Nature of Government and Laws, Obedience and Rebellion, Peace and War: Nay rather a Man that relies altogether on such universal Precepts, is almost certain to miscarry. But there must be a Sagacity of Judgment in particular Things; a Dexterity in discerning the Advantages of Occasions; a Study of the Humour, and Interest of the People he is to govern: The same is to be found in *Philosophy*; a thousand fine Argumentations, and Fabricks in the Mind, concerning the Nature of *Body*, *Quantity*, *Motion*, and the like, if they only hover a-loof, and are not squar'd to particular Matters, they may give an empty Satisfaction, but no Benefit, and rather serve to *swell*, than *fill* the Soul.

But besides this, the very way of *Disputing* itself, and inferring one Thing from another alone, is not at all proper for the spreading of Knowledge. It serves admirably well indeed, in those Arts, where the Connection between the Propositions is necessary, as in the *Mathematicks*, in which a long Train of *Demonstrations*, may be truly collected, from the certainty of

the first Foundation: But in things of probability only, it seldom or never happens, that after some little Progress, the main Subject is not left, and the Contenders fall not into other Matters, that are nothing to the Purpose: For if but one Link in the whole Chain be loose, they wander far away, and seldom, or never recover their first Ground again. In brief, *Disputing* is a very good Instrument to sharpen Men's Wits, and to make them versatile, and wary Defenders of the Principles, which they already know: but it can never much augment the *solid Substance* of *Science* itself: And methinks compar'd to *Experimenting*, it is like *Exercise* to the Body in Comparison of *Meat:* For Running, Walking, Wrestling, Shooting, and other such active Sports, will keep Men in Health, and Breath, and a vigorous Temper: but it must be a supply of new Food that must make them grow: so it is in this Case; much Contention, and Strife of Argument, will serve well to explain obscure things, and strengthen the weak, and give a good, sound, masculine Colour, to the whole Mass of Knowledge: But it must be a continued addition of Observations, which must nourish, and increase and give new Blood, and Flesh, to the *Arts* themselves.

But this has been only hitherto spoken, against the *Method* of the *School-men* in general; on supposition, that they took the best Course, that could be in that Kind. I shall now come to weigh that too. For it may easily be prov'd, that those very Theories, on which they built all their subtile Webs, were not at all collected, by a sufficient Information from the things themselves; which if it can be made out, I hope it will be granted, that the Force and Vigour of their Wit did more hurt, than good: and only

only ſerv'd to carry them the faſter out of the right Way, when they were once going. The *Peripateticks* themſelves do all grant, that the firſt Riſe of Knowledge muſt be from the *Senſes*, and from an Induction of their Reports: Well then; how could the *School-men* be proper for ſuch a Buſineſs, who were ty'd by their Cloyſtral Life to ſuch a Strictneſs of Hours, and had ſeldom any larger Proſpects of *Nature*, than the Gardens of their *Monaſteries?* It is a common Obſervation, that Men's Studies are various according to the different Courſes of Life, to which they apply themſelves; or the Tempers of the Places, wherein they live. They who are bred up in *Commonwealths*, where the greateſt Affairs are manag'd by the Violence of popular Aſſemblies, and thoſe govern'd by the moſt plauſible Speakers, buſy themſelves chiefly about *Eloquence*; they who follow a *Court*, eſpecially intend the Ornament of Language, and *Poetry*, and ſuch more delicate Arts, which are uſually there in moſt Requeſt: they who retire from human things, and ſhut themſelves up in a narrow Compaſs, keeping Company with a very few, and that too in a ſolemn way, addict themſelves, for the moſt part, to ſome melancholy Contemplations, or to *Devotion*, and the Thoughts of another World. That therefore which was fitteſt for the *School-men's* way of life, we will allow them: But what ſorry Kinds of Philoſophy muſt they needs produce, when it was a part of their *Religion*, to ſeparate themſelves, as much as they could, from the Converſe of Mankind? when they were ſo far from being able to diſcover the Secrets of *Nature*, that they had ſcarce Opportunity, to behold enough of its common Works. If any ſhall be inclinable to fol-

low the Directions of ſuch Men in natural Things, rather than of thoſe, who make it their Employment; I ſhall believe they will be irrational enough, to think, that a Man may draw an exacter Deſcription of *England*, who has never been here, than the moſt induſtrious Mr. *Camden*, who had travell'd over every Part of this Country, for that very Purpoſe.

Whoever ſhall ſoberly profeſs, to be willing to put their Shoulders under the Burthen of ſo great an Enterprize, as to repreſent to Mankind the whole Fabrick, the Parts, the Cauſes, the Effects of Nature, ought to have their Eyes in all Parts, and to receive Information from every Quarter of the Earth; they ought to have a conſtant univerſal Intelligence; all Diſcoveries ſhould be brought to them; the Treaſuries of all former Times ſhould be laid open before them; the Aſſiſtance of the preſent ſhould be allow'd them: So far are the narrow Conceptions of a few private Writers, in a dark Age, from being equal to ſo vaſt a Deſign. There are indeed ſome Operations of the Mind, which may be beſt perform'd by the ſimple Strength of Men's own particular Thoughts; ſuch are Invention, and Judgment, and Diſpoſition: For in them a Security from Noiſe, leaves the Soul at more Liberty, to bring forth Order, and faſhion the Heap of Matter, which had been before ſupply'd to its Uſe. But there are other Works alſo, which require as much Aid, and as many Hands, as can be found: And ſuch is this of Obſervation; which is the great Foundation of Knowledge; ſome muſt gather, ſome muſt bring, ſome ſeparate, ſome examine; and to uſe a Similitude, (which the preſent Time of the Year, and the ripe Fields, that lye before

before my Eyes, ſuggeſt to me) it is in *Philoſophy*, as in *Husbandry*; wherein we ſee, that a few Hands will ſerve to meaſure out, and fill into Sacks, that Corn, which requires very many more Labourers, to ſow, and reap, and bind, and bring it into the Barn.

But now it is time for me to diſmiſs this ſubtile Generation of Writers; whom I would not have proſecuted ſo far, but that they are ſtill eſteem'd by ſome Men, the only Maſters of Reaſon. If they would be content with any thing leſs than an Empire in Learning, we would grant them very much. We would permit them to be great and profound Wits, as *Angelical*, and *Seraphical*, as they pleas'd: we would commend them, as we are wont to do *Chaucer*; we would confeſs, that they are admirable in Compariſon of the Ignorance of their own Age: And, as Sir *Philip Sidney* ſaid of him, we would ſay of them; that it is to be wonder'd, how they could ſee ſo clearly then, and we can ſee no clearer now: But that they ſhould ſtill be ſet before us, as the great Oracles of all Wit, we can never allow. Suppoſe, that I ſhould grant, that they are moſt uſeful in the Controverſies of our *Church*, to defend us againſt the Hereſies, and Schiſms of our Times; what will thence follow, but that they ought to be confin'd within their own Bounds, and not to be ſuffer'd to hinder the Enlargement of the Territories of other *Sciences*? Let them ſtill prevail in the *Schools*, and let them govern in Diſputations: But let them not over-ſpread all Sorts of Knowledge. That would be as ridiculous, as if, becauſe we ſee, that Thorns, and Briers, by Reaſon of their Sharpneſs, are fit to ſtop a Gap, and keep out wild Beaſts; we ſhould therefore think, they deſerv'd to be planted all over every Field.

And yet I ſhould not doubt, (if it were not ſomewhat improper to the preſent Diſcourſe) to prove, that even in *Divinity* it ſelf, they are not ſo neceſſary, as they are reputed to be: and that all, or moſt of our Religious Controverſies, may be as well decided, by plain Reaſon, and by Conſiderations, which may be fetch'd from the *Religion* of *Mankind*, the Nature of *Government*, and *human Society*, and *Scripture* it ſelf, as by the Multitudes of Authorities, and Subtleties of Diſputes, which have been heretofore in Uſe.

Sect. X. *The Reſtoration of Learning.*

And now I am come to the Time within our View and to the *third great Age* of the *flouriſhing* of *Learning*. Whether this Recovery of Knowledge did happen by the benefit of *Printing*, invented about that Time, which ſhew'd a very eaſy Way of communicating Men's Thoughts one to another; or whether it came from the Hatred, which was then generally conceiv'd againſt the Blindneſs, and Stupidity, of the *Roman Fryars*; or from the *Reformation*, which put Men upon a ſtricter Inquiry into the Truth of things; whatever the *Cauſe* was, I will not take much Pains to determine: but I will rather obſerve, what Kinds of Knowledge have moſt flouriſh'd upon it. If we compare this *Age* of *Learning*, with the *two former*; we ſhall find, that this does far exceed both the other in its Extent: there being a much larger Plat of Ground, ſown with Arts and Civility at this time, than either when the *Grecian* or *Roman* Empires prevail'd. For then (eſpecially under the *Romans*) ſo many Nations being united under one *Dominion*, and reduc'd into the Form of *Provinces*: that Knowledge which they had was chiefly confin'd

to

to the Walls of the *Imperial Cities* themſelves. But now (not to inſiſt on the Learning of far remote Countries, of which we have only imperfect Relations; but to contract our Obſervation to *Chriſtendom* alone) there being ſo many different *States*, and *Governments* in *Europe*, every Country ſets up for itſelf: almoſt in every place, the liberal Arts (as they are call'd) are cheriſh'd, and publick Allowance is made for their Support. And in this Compaſs, the infinite Numbers of Wits, which have appear'd ſo thick for theſe many Years, have been chiefly taken up about ſome of theſe three Studies; either the *Writings* of the *Antients*, or *Controverſies* of *Religion*, or *Affairs of State*.

Sect. XI. *The Recovery of the Antients.*

The firſt Thing that was undertaken, was to reſcue the excellent Works of former *Writers* from Obſcurity. To the better performing of this, many things contributed about that time. Amongſt which, as to us in *England*, I may reckon (and that too, it may be, not the leaſt, whatever the Action was in itſelf,) the Diſſolution of *Abbies*: whereby their Libraries came forth into the Light; and fell into induſtrious Men's Hands, who underſtood how to make more Uſe of them, than their ſlothful Poſſeſſors had done. So that now the *Greek* and *Latin* Tongues began to be in Requeſt; and all the ancient Authors, the *Heathen Philoſophers*, *Mathematicians*, *Orators*, *Hiſtorians*, *Poets*, the various Copies, and Tranſlations of the *Bible*, and the *Primitive Fathers* were produc'd. All theſe, by the ſeveral Tranſcriptions, and the Ignorance of the Tranſcribers, had very many different Readings, and many Parts wholly loſt; and by the Diſtance of Times, and Change of Cuſtoms, were

were grown obſcure. About the interpreting, explaining, ſupplying, commenting on theſe, almoſt all the firſt Wits were employed. A Work of great Uſe, and for which we ought to eſteem our ſelves much beholden to them. For indeed, if they had not compleated that Buſineſs, to our Hands, we of this Age, had not been ſo much at Leiſure, as now I hope we are, to proſecute new Inventions. If they had not done it, we ſhould; of which we ought not to doubt, ſeeing we behold, that even now, when the Soil of Criticiſm is almoſt quite barren, and hardly another Crop will come, yet many learned Men cannot forbear ſpending their whole Labour in toyling about it; what then ſhould we have done, if all thoſe Books had come down untouch'd to our Hands?

We cannot then, with any Sobriety, detract from the *Criticks*, and *Philologiſts*, whoſe Labours we enjoy. But we ought rather to give them this Teſtimony, that they were Men of admirable Diligence: and that the Collections, which they have made, out of the Monuments of the *Antients*, will be wonderfully advantageous to us, if the right Uſe be made of them; if they be not ſet before us, only that we may ſpend our whole Lives in their Conſideration, and to make the Courſe of Learning more difficult: But if they be imploy'd, to direct us in the Ways that we ought to proceed in Knowledge for the future; if by ſhewing us what has been already finiſh'd, they point out to us, the moſt probable Means, to accompliſh what is behind. For methinks, that Wiſdom, which they fetch'd from the Aſhes of the Dead, is ſomething of the ſame Nature with Aſhes themſelves; which, if they are kept up in Heaps together,

will be uſeleſs: But if they are ſcattered upon living Ground, they will make it more fertile, in the bringing forth of various Sorts of Fruits. To theſe Men then we are beholden, that we have a fairer Proſpect about us: to them we owe, that we are not ignorant of the times that are gone before us; which to be, is (as *Tully* ſays) *to be always Children.* All this, and much more, is to be acknowledg'd: But then we ſhall alſo deſire of them, that they would content themſelves with what is their Due: that by what they have diſcover'd, amongſt the Rubbiſh of the *Antients*, they would not contemn the Treaſures, either lately found out, or ſtill unknown; and that they would not prefer the *Gold* of *Ophir*, of which now there is no mention but in Books, before the preſent Mountains of the *Weſt Indies.*

Sect. XII. *Religious Controverſies and Arts of the Moderns.*

Thus I paſs over this Sort of *reviv'd learning.* And now there comes into our View another remarkable Occaſion of the Hindrance of the Growth of *experimental Philoſophy*, within the Compaſs of this bright Age; and that is the great a-do which has been made, in raiſing, and confirming, and refuting ſo many different Sects, and Opinions of the *Chriſtian Faith.* For whatever other Hurt or Good comes by ſuch holy ſpeculative Wars (of which whether the Benefit or Miſchief over-weighs, I will not now examine) yet certainly by this means, the Knowledge of Nature has been very much retarded. And (to uſe that Metaphor, which an excellent *Poet* of our Nation turns to another purpoſe) that Shower has done very much Injury by falling on the Sea, for which the Shepherd and the Plough-man call'd in vain: The Wit of Men has been profuſely pour'd out

on *Religion*, which needed not its help, and which was only thereby made more tempestuous; while it might have been more fruitfully spent, on some Parts of Philosophy, which have been hitherto barren, and might soon have been made fertile.

But besides this, there have been also several other *Professions*, which have drawn away the Inclinations of Men, from prosecuting the naked and uninteressed Truth. And of these I shall chiefly name the *Affairs* of *State*, the Administration of civil Government, and the Execution of Laws. These by their fair Dowry of Gain and Honour, have always allur'd the greatest Part of the Men of Art, and Reason, to addict themselves to them: while the Search into severer Knowledge has been look'd on, as a Study out of the Way, fitter for a melancholy Humorist, or a retir'd weak Spirit, than to make Men equal to Business, or serviceable to their Country. And in this, methinks, the *experimental Philosophy* has met with very hard Usage. For it has commonly, in Men's Censures, undergone the Imputation of those very Faults, which it endeavours to correct in the *verbal*. That indeed may be justly condemn'd for filling Men's Thoughts with imaginary Ideas of Conceptions, that are no way answerable to the practical ends of Life: But this, on the other side, (as I shall shortly make out) is the surest Guide, against such notional Wandrings; opens our Eyes to perceive all the Realities of Things; and clears the Brain, not only from Darkness, but false or useless Light. This is certainly so in the Thing it self: But the greatest Part of Men have still apprehended the contrary. If they can bring such Inquirers under the scornful Titles of *Philosophers*, or *Scholars*, or *Virtuosi*, it is enough; They presently

ſently conclude them to be Men of another World, only fit Companions for the Shadow, and their own melancholy Whimſies; looking on thoſe who dig in the Mine of Nature, to be in as bad a Condition, as the *King* of *Spain*'s Slaves in *Peru*, condemn'd for ever to that Drudgery, and never to be redeem'd to any other Imployment. And is not this a very unequal Proceeding? While ſome over-zealous *Divines* do reprobate natural Philoſophy as a carnal Knowledge, and a too much minding worldly Things; the Men of the World, and Buſineſs, on the other ſide, eſteem it merely as an idle Matter of Fancy, and as that which diſables us from taking right Meaſures in human Affairs. Thus, by the one Party, it is cenſur'd for ſtooping too low; by the other, for ſoaring too high: ſo that, methinks, it is a good Ground to conclude, that it is guilty of neither of theſe Faults, ſeeing it is alike condemn'd by both the Extremes. But I ſhall have a fitter Occaſion to examine this hereafter. However it be, it is not to be wonder'd, if Men have not been very zealous about thoſe Studies, which have been ſo far removed from preſent Benefit, and from the Applauſe of Men. For what ſhould incite them to beſtow their Time, and Art, in revealing to Mankind thoſe Myſteries, for which, it may be, they would be only deſpis'd at laſt? How few muſt there needs be, who will be willing to be impoveriſh'd for the common Good, while they ſhall ſee all the Rewards, which might give Life to their Induſtry paſſing by them, and beſtow'd on the Deſerts of eaſier Studies? and while they, for all their Pains, and publick Spirit, ſhall only perhaps be ſerved, as the poor Man was in the *Fable*; who, while he went down into the Well, in Aſſurance,

that he ſhould find a mighty Treaſure there, was in the mean time robb'd by his Companions, that ſtay'd above, of his Cloak, and all the Booty that he had before gotten?

*The Philoſophy of the Moderns.*

And yet, notwithſtanding all theſe unfortunate Hindrances, there have been many commendable Attempts in this Way, in the Compaſs of our Memories, and the Age before us. And though they have been for the moſt part carry'd on, by the private Diligence of ſome few Men, in the midſt of a thouſand Difficulties, yet it will not be unprofitable to recount ſome of them; if it were only to give a fair Ground of Hope, how much Progreſs may be made by a form'd and regular *Aſſembly*, ſeeing ſome ſingle Hands, with ſo ſmall Encouragement, could diſpatch ſo much of the Work.

There are five *new Ways* of *Philoſophy*, that come into my Obſervation.

Sect. XIII. *Modern Dogmatiſts.*

The firſt is, of thoſe, who, out of a juſt Diſdain that the *Antients* ſhould ſtill poſſeſs a Tyranny over our Judgments, began firſt to put off the Reverence that Men had born to their Memories; and handling them more familiarly, made an exact Survey of their Imperfections: But then, having rejected them, they purſue their Succeſs too far, and ſtrait fell to form and impoſe new Theories on Men's Reaſon, with an Uſurpation as great as that of the others: An Action, which we that live in this Age, may reſemble to ſome things that we have ſeen acted on the Stage of the World: For we alſo have beheld the Pretenders to publick Liberty, turn the greateſt *Tyrants* themſelves. The firſt part of theſe Men's Performance is very much to be prais'd: They have made the

Ground open and clear for us; they have remov'd the Rubbiſh; which, when one great Fabrick is to be pull'd down, and another to be erected in its ſtead, is always eſteem'd well nigh half the whole Work: Their Adventure was bold, and hazardous: They touch'd Men's Minds in their tendereſt Part, when they ſtrove to pluck off thoſe Opinions, which had, by long Cuſtom, been ſo cloſely twin'd about them: They freed our Underſtandings from the Charms of vain Apparitions, and a Slavery to dead Men's Names. And we may well gueſs, that the abſolute Perfection of the *true Philoſophy* is not now far off, ſeeing this firſt great and neceſſary Preparation for its coming, is already taken off our Hands. For methinks there is an Agreement, between the Growth of *Learning*, and of *Civil Government*. The Method of the Riſe and Increaſe of that, was this: At firſt in every country there prevailed nothing but Barbariſm and Rudeneſs: All places were terrible with *Giants*, and Enchantments, and inſolent Uſurpers: Againſt theſe there firſt aroſe ſome mighty *Heroes*, as *Hercules*, *Theſeus*, and *Jaſon*: Theſe ſcowred the World, redreſs'd Injuries, deſtroy'd Monſters; and for this they were made *Demi-gods*. But then they gave over, and it was left to the great Men, who ſucceeded them, as *Solon*, and *Lycurgus*, to accompliſh the Work, to found Common-wealths, to give Laws, to put Juſtice in its Courſe: And why may I not now preſume, (as many others have done before me) to reduce theſe Stories to a philoſophical Senſe? Firſt then, the Phantaſms, and Fairies, and venerable Images of Antiquity, did long haunt the World; againſt theſe we have had our Champions; and without all queſtion, they had the better of the

Cauſe;

Cauſe; and now we have good Ground to truſt, that theſe Illuſions being well over, the laſt finiſhing of this great Work is nigh at Hand, and is reſerv'd for this Undertaking.

So then, thus far they did well. But in the ſecond Part of their Enterprize, they themſelves ſeem to me to have run into the ſame Miſtake, for which we chiefly complain'd againſt thoſe *Antients*, whoſe Authority they deſtroy'd. The greateſt occaſion of our diſſenting from the *Greek Philoſophers*, and eſpecially from *Ariſtotle*, was, that they made too much Haſte to ſeize on the Prize, before they were at the End of the Race; that they fix'd and determin'd their Judgments on general Concluſions too ſoon, and ſo could not afterwards alter them, by any new Appearances, which might repreſent themſelves. And may not we ſuppoſe, that Poſterity will have the ſame Quarrel at theſe Men's Labours? We do not fall foul upon Antiquity, out of any Singularity of Opinion, or a preſumptuous Confidence of the Strength of our Wits above theirs; we admire the Men, but only diſlike the Method of their Proceedings. And can we forbear murmuring, if we ſee our *Cotemporaries* diſdain them, and yet imitate their Failings? If we muſt conſtitute a Sovereignty over our Reaſons; I know not why we ſhould not allow this Dominion to the *Antients*, rather than to any one of the Moderns. They are all dead long ſince; and though we ſhould be over-reach'd by them in ſome few Falſehoods, yet there is no Danger, leſt they ſhould increaſe them upon us; whereas, if we once hang on the Lips of the wiſeſt Men now living; we are ſtill in their Power, and under their Diſcipline, and ſubject to be led by all their Dictates for the future. It

is true indeed, a diligent *Inquirer* of these Times may gather as much Experience, and in probability, conclude as rightly, as a whole *Academy*, or Sect of theirs could; yet I shall still deny, that any one Man, though he has the nimblest, and most universal Observation, can ever, in the Compass of his Life, lay up enough Knowledge, to suffice all that shall come after him to rest upon, without the Help of any new Inquiries.

And if we suppose the best, that some one Man, by wonderful Sagacity, or extraordinary Chance, shall light upon the true Principles of natural Philosophy; yet what will be the Profit of such universal Demonstrations, if they are only fitted for Talk, and the solving of Appearances? Will there be any great Matter, whether they are certain, or doubtful; old, or new; if they must be only bounded to a System, and confin'd to Discourse? The true Philosophy must be first of all begun, on a scrupulous, and severe Examination of Particulars: from them there may be some general Rules with great Caution drawn: But it must not rest there, nor is that the most difficult Part of its Course. It must advance those Principles, to the finding out of new Effects, through all the Varieties of Matter; and so both the Courses must proceed orderly together; from experimenting to demonstrating, and from demonstrating to experimenting again. I hope I shall content my Reader, if I only give one Instance in this Case. It is probable, that he who first discover'd, that all Things were order'd in *Nature* by *Motion*; went upon a better Ground, than any before him. But now if he will only manage this, by nicely disputing about the Nature, and Causes of

*Motion*

*Motion* in general, and not proſecute it through all particular Bodies; to what will he at laſt arrive, But only to a better Sort of *Metaphyſicks?* And it may be, his Followers, ſome Ages hence, will divide his Doctrine into as many Diſtinctions, as the *School-men* did that of *Matter* and *Form*; and ſo the whole Life of it will alſo vaniſh away into Air and Words, as that of theirs has already done.

Sect. XIV. *The ill effects of dogmatical Philoſophy.*

But it is time for me to give over this Argument; in which, I fear, that what I have already ſaid, will alarm ſome excellent Men, whoſe Abilities I admire; who may perhaps ſuſpect, that it has been with a particular Reflection. I might ſay for my ſelf, that firſt they muſt paſs Sentence on themſelves, before they can think ſo, ſeeing I have nam'd no Man. But I will rather ſincerely profeſs, that I had no ſatyrical Senſe, but only declar'd againſt *Dogmatiſts* in general. And I cannot repent my having done it, while I perceive there are two very dangerous Miſchiefs, which are caus'd by that way of Philoſophy. The one is, that it makes Men give over, and believe that they are ſatisfy'd, too ſoon. This is of very ill Conſequence; for thereby Men's Induſtry will be ſlackned, and all the Motives to any farther Purſuit taken away. And indeed this is an Error, which is very natural to Men's Minds; they love not a long and a tedious Doubting, though it brings them at laſt to a real Certainty; but they chooſe rather to conclude preſently, than to be long in Suſpence, though to better purpoſe. And it is with moſt Men's Underſtandings, as with their Eyes; to which thoſe ſeem more delightful Proſpects, where Varieties of Hills and Woods do ſoon bound their Wandrings, than where there is one large

large ſmooth *Champagn*, over which they may ſee much farther, but where there is nothing to delay, and ſtop, and divert the Sight.

But the other ill Effect, of which I ſhall take notice, is, that it commonly inclines ſuch Men, who think themſelves already reſolved, and immoveable in their Opinions, to be more imperious, and impatient of Contradiction, than becomes the Calmneſs, and unpaſſionate Evenneſs of the true philoſophical Spirit. It makes them prone to undervalue other Mens Labours, and to neglect the real Advantage, that may be gotten by their Aſſiſtance; leſt they ſhould ſeem to darken their own Glory. This is a Temper of Mind of all others the moſt pernicious; to which I may chiefly attribute the Slowneſs of the Increaſe of Knowledge amongſt Men. For what great Things can be expected, if Mens Underſtandings ſhall be as it were always in the warlike State of Nature, one againſt another? If every one be jealous of another's Inventions, and ſtill ready to put a Stop to his Conqueſts? Will there not be the ſame wild Condition in Learning, which had been amongſt Men, if they had always been diſpers'd, ſtill preying upon and ſpoiling their Neighbours? If that had ſtill continued, no Cities had been built, no Trades found out, no Civility taught: For all theſe noble Productions came from Men's joining in Compacts, and entring into *Society*. It is an uſual ſaying, that *where the natural Philoſopher ends, the Phyſician muſt begin*: And I will alſo add,, that *the natural Philoſopher is to begin, where the moral ends*. It is requiſite, that he who goes about ſuch an Undertaking, ſhould firſt know himſelf, ſhould be well practis'd in all the modeſt, humble, friendly Virtues; ſhould be willing

to be taught, and to give way to the Judgment of others. And I dare boldly ſay, that a plain induſtrious Man, ſo prepar'd, is more likely to make a good Philoſopher, than all the high, earneſt, inſulting Wits, who can bear neither Partnerſhip, nor Oppoſition. The *Chymiſts* lay it down, as a neceſſary Qualification of their happy Man, to whom God will reveal their ador'd *Elixir*, that he muſt be rather innocent, and virtuous, than knowing. And if I were to form the Character of a true Philoſopher, I would be ſure to make that the Foundation: Not that I believe, God will beſtow any extraordinary Light in Nature, on ſuch Men more than others; but upon a bare rational Account: For certainly, ſuch Men, whoſe Minds are ſo ſoft, ſo yielding, ſo complying, ſo large, are in a far better Way, than the bold and haughty Aſſerters: they will paſs by nothing, by which they may learn; they will be always ready to receive, and communicate Obſervations; they will not contemn the Fruits of others Diligence; they will rejoice to ſee Mankind benefited, whether it be by themſelves or others.

Sect. XV. *The Revivers of the Ancient Sects.*

The ſecond Endeavours have been of thoſe, who renounc'd the Authority of *Ariſtotle*; but then reſtor'd ſome one or other of the *Ancient Sects* in his ſtead. If ſuch Mens Intentions were only, that we might have before us the Conceptions of ſeveral Men of different Ages, upon the Works of Nature, without obliging us to an implicit Conſent to all that they affirm; then their Labours ought to be receiv'd with great Acknowledgments: For ſuch a general Proſpect will very much inlarge, and guide our Inquiry; and perhaps alſo will help to hinder the Age

from ever falling back again into a Subjection to one uſurping Philoſopher. But if their Purpoſe was, to erect thoſe Schools which they reviv'd, into as abſolute a Power, as the *Peripateticks* had heretofore; if they ſtrive to make a Competition between *Ariſtotle* and *Epicurus*, or *Democritus*, or *Philolaus*; they do not contribute very much, towards the main Deſign: For towards that, it is not enough, that the *Tyrant* be chang'd; but the *Tyranny* it ſelf muſt be wholly taken away.

Sect. XVI. *Modern Experimenters.*

The *third* Sort of *new Philoſophers* have been thoſe, who have not only diſagreed from the *Ancients*, but have alſo propos'd to themſelves the right Courſe of ſlow and ſure *Experimenting*; and have proſecuted it as far, as the Shortneſs of their own Lives, or the Multiplicity of their other Affairs, or the Narrowneſs of their Fortunes, have given them leave. Such as theſe we are to expect to be but few; for they muſt diveſt themſelves of many vain Conceptions, and overcome a thouſand falſe Images, which lye like Monſters in their Way, before they can get as far as this. And of theſe, I ſhall only mention one great Man, who had the true Imagination of the whole Extent of this Enterpriſe, as it is now ſet on foot; and that is, the Lord *Bacon*; in whoſe Books there are every where ſcattered the beſt Arguments, that can be produc'd for the Defence of experimental Philoſophy, and the beſt Directions, that are needful to promote it: All which he has already adorn'd with ſo much Art; that if my Deſires could have prevailed with ſome excellent Friends of mine, who engag'd me to this Work, there ſhould have been no other Preface to the *Hiſtory* of the *Royal Society*,

*ciety*, but ſome of his Writings. But methinks, in this one Man, I do at once find enough Occaſion, to admire the Strength of human Wit, and to bewail the Weakneſs of a mortal Condition. For is it not wonderful, that he, who had run through all the Degrees of that *Profeſſion*, which uſually takes up Men's whole Time; who had ſtudied, and practis'd, and govern'd the *common Law*; who had always liv'd in the Crowd, and born the greateſt Burden of civil Buſineſs; ſhould yet find Leiſure enough for theſe retir'd Studies, to excel all thoſe Men, who ſeparate themſelves for this very purpoſe? He was a Man of ſtrong, clear, and powerful Imaginations; his Genius was ſearching and inimitable; and of this I need give no other Proof than his Style it ſelf; which as, for the moſt part, it deſcribes Men's Minds, as well as Pictures do their Bodies, ſo did his above all Men living. The Courſe of it vigorous, and majeſtical; the Wit bold, and familiar; the Compariſons fetch'd out of the Way, and yet the more eaſy: In all expreſſing a Soul, equally skill'd in Men, and Nature. All this and much more is true of him; but yet his *Philoſophical Works* do ſhew, that a ſingle and buſy Hand can never graſp all this whole Deſign, of which we treat. His Rules were admirable; yet his *Hiſtory* not ſo faithful, as might have been wiſh'd, in many Places; he ſeems rather to take all that comes, than to chooſe, and to heap, rather than to regiſter. But I hope this Accuſation of mine can be no great Injury to his Memory; ſeeing, at the ſame time, that I ſay he had not the Strength of a thouſand Men, I do alſo allow him to have had as much as twenty.

The next Philoſophers, whom I ſhall touch upon, are the *Chymiſts*, who have been more numerous, in this latter Age, than ever before. And without queſtion, they have lighted upon the right Inſtrument of great Productions and Alterations; which muſt for the moſt part be perform'd by Fire. They may be divided into three Ranks: Such, as look after the Knowledge of Nature in general; ſuch, as ſeek out, and prepare Medicines; and ſuch, as ſearch after Riches, by Tranſmutations, and the great *Elixir*. The two firſt have been very ſucceſsful, in ſeparating, compounding, and changing the Parts of Things; and in ſhewing the admirable Powers of Nature, in the raiſing of new Conſiſtencies, Figures, Colours, and Virtues of Bodies: And from their Labours, the true *Philoſophy* is like to receive the nobleſt Improvements. But the Pretenſions of the third Kind are, not only to indow us with all the Benefits of this Life, but with Immortality it ſelf: And their Succeſs has been as ſmall, as their Deſign was extravagant. Their Writers involve them in ſuch Darkneſs; that I ſcarce know, which was the greateſt Task, to underſtand their Meaning, or to effect it. And in the Chaſe of the *Philoſopher's Stone*, they are ſo earneſt, that they are ſcarce capable of any other Thoughts; ſo that if an Experiment lye ever ſo little out of their Road, it is free from their Diſcovery; as I have heard of ſome Creatures in *Africk*, which ſtill going a violent Pace ſtrait on, and not being able to turn themſelves, can never get any Prey, but what they meet juſt in their Way. This Secret they proſecute ſo impetuouſly, that they believe they ſee ſome Footſteps of it, in every Line of *Moſes*, *Solomon*, or *Virgil*. The Truth is, they are downright *Enthuſiaſts* about

Sect. XVII. *The Chymiſts.*

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about it. And seeing we cast *Enthusiasm* out of *Divinity* it self, we shall hardly sure be perswaded, to admit it into Philosophy. It were perhaps a vain Attempt, to try to cure such Men of their groundless Hopes. It may be they are happier now, as they are: And they would only cry out with the Man in *Horace*, that their Friends, who had restor'd them to a perfect Sense, had murder'd them. But certainly, if they could be brought to content themselves with moderate Things, to grow rich by Degrees, and not to imagine, they shall gain the *Indies* out of every *Crucible*; there might be wonderful Things expected from them. And of this we have good assurance, by what is come abroad from diverse eminent Persons; amongst whom some are Members of the *Royal Society*. And, if it were not already excellently perform'd by others, I might here speak largely, of the Advantages that accrue to Physick, by the industrious Labours of such *Chymists*, as have only the discreet, and sober Flame, and not the wild Lightning of the others Brains.

Sect. XVIII. *Those that have handled particular Subjects.*

But the last Kind, that I shall name, has been of those, who conscious of human Frailty, and of the Vastness of the Design of an *universal Philosophy*, have separated, and chosen out for themselves, some particular Subjects, about which to bestow their Diligence. In these, there was less Hazard of Failing; these by one Man's Industry, and constant Indeavours, might probably at last be overcome: And indeed they have generally reap'd the Fruits of their Modesty. I have but one thing to except against some few of them; that they have been sometimes a little too forward to conclude upon *Axioms*, from what they

they have found out, in ſome particular Body. But that is a Fault, which ought to be overwhelm'd by their other Praiſes: And I ſhall boldly affirm, that if all other Philoſophical Matters had been as well and as throughly ſifted, as ſome admirable Men of this Age have manag'd ſome parts of *Aſtronomy*, *Geometry*, *Anatomy*, &c. there would ſcarce any Burden have remained on the Shoulders of our Poſterity; but they might have ſat quietly down, and injoy'd the Pleaſure of the true *Speculative* Philoſophy, and the Profit of the *Practical*.

To all theſe Proceedings, that I have mention'd there is as much Honour to be paid, as can be due to any one ſingle human Wit: But they muſt pardon us, if we ſtill prefer the joint Force of many Men.

Sect. XIX. *Modern Academies for Language.*

And now it is much to be wondred, that there was never yet ſuch an *Aſſembly* erected, which might proceed on ſome ſtanding Conſtitutions of Experimenting. There have, 'tis true, of late, in many Parts of *Europe*, ſome Gentlemen met together, ſubmitted to common Laws, and form'd themſelves into *Academies*: But it has been, for the moſt Part, to a far different Purpoſe; and moſt of them only aim'd at the ſmoothing of their Style, and the Language of their Country. Of theſe, the firſt aroſe in *Italy*: where they have ſince ſo much abounded, that there was ſcarce any one great City without one of theſe *Combinations*. But that, which excell'd all the other, and kept it ſelf longer untainted from the Corruptions of Speech, was the *French Academy* at *Paris*. This was compos'd of the nobleſt Authors of that Nation; and had for its *Founder*, the *Great Cardinal de Richelieu*: who, amongſt all his Cares, whereby he eſtabliſh'd,

bliſh'd and enlarg'd that *Monarchy* ſo much, did often refreſh himſelf by directing, and taking an Account of their Progreſs. And indeed in his own Life he found ſo great Succeſs of this Inſtitution, that he ſaw the *French Tongue* abundantly purified, and beginning to take place in the Weſtern World, almoſt as much as the *Greek* did of old, when it was the Language of Merchants, Soldiers, Courtiers, and Travellers. But I ſhall ſay no more of this *Academy*, that I may not deprive my Reader of the Delight of peruſing their own *Hiſtory*, written by *Monſieur de Peliſſon*; which is ſo maſculine, ſo chaſtly, and ſo unaffectedly done, that I can hardly forbear envying the *French Nation* this Honour; that while the *Engliſh Royal Society* has ſo much out-gone their *Illuſtrious* Academy, in the Greatneſs of its Undertaking, it ſhould be ſo far ſhort of them in the Abilities of its *Hiſtorian*. I have only this to alledge in my Excuſe; that as they undertook the Advancement of the Elegance of Speech, ſo it became their *Hiſtory* to have ſome Reſemblance to their Enterprize: Whereas the Intention of ours being not the Artifice of Words, but a bare Knowledge of Things; my Fault may be eſteem'd the leſs, that I have written of *Philoſophers* without any Ornament of *Eloquence*.

Sect. XX. *A Propoſal for erecting an Engliſh Academy.*

I hope now it will not be thought a vain Digreſſion, if I ſtep a little aſide, to recommend the forming of ſuch an *Aſſembly* to the Gentlemen of our Nation. I know indeed, that the *Engliſh Genius* is not ſo airy and diſcurſive, as that of ſome of our Neighbours, but that we generally love to have Reaſon ſet out in plain undeceiving Expreſſions; as much as they to have it deliver'd with Colour and Beauty. And beſides

ſides this, I underſtand well enough, that they have one great Aſſiſtance to the Growth of Oratory, which to us is wanting: that is, that their Nobility live commonly cloſe together in their Cities, and ours for the moſt part ſcattered in their Country Houſes. For the ſame reaſon, why our Streets are not ſo well built as theirs, will hold alſo, for their exceeding us in the Arts of Speech: They prefer the Pleaſures of the Town, we thoſe of the Field; whereas it is from the frequent Converſations in Cities, that the Humour, and Wit, and Variety, and Elegance of Language, are chiefly to be fetch'd. But yet, notwithſtanding theſe Diſcouragements, I ſhall not ſtick to ſay, that ſuch a Project is now ſeaſonable to be ſet on foot, and may make a great Reformation in the manner of our Speaking and Writing. Firſt, the Thing itſelf is no way contemptible: For the Purity of Speech, and Greatneſs of Empire have, in all Countries, ſtill met together. The *Greeks* ſpake beſt, when they were in their Glory of Conqueſt. The *Romans* made thoſe Times the Standard of their Wit, when they ſubdued, and gave Laws to the World: And from thence, by degrees, they declin'd to Corruption, as their Valour, their Prudence, and the Honour of their Arms did decay; and at laſt, did even meet the *Northern Nations* half way in *Barbariſm*, a little before they were overrun by their *Armies*.

But beſides, if we obſerve well the *Engliſh Language*, we ſhall find, that it ſeems at this time, more than others, to require ſome ſuch Aid, to bring it to its laſt Perfection. The Truth is, it has been hitherto a little too careleſly handled; and, I think, has had leſs Labour ſpent about its poliſhing than it de-

ſerves. Till the time of *King Henry* the *Eighth*, there was ſcarce any Man regarded it, but *Chaucer*; and nothing was written in it, which one would be willing to read twice, but ſome of his *Poetry*. But then it began to raiſe itſelf a little, and to ſound tolerably well. From that Age, down to the beginning of our late *Civil Wars*, it was ſtill faſhioning, and beautifying itſelf. In the Wars themſelves, which is a time wherein all Languages uſe, if ever, to increaſe by extraordinary degrees; (for in ſuch buſie and active times, there ariſe more new Thoughts of Men, which muſt be ſignified, and varied by new Expreſſions) then, I ſay, it receiv'd many fantaſtical Terms, which were introduc'd by our *Religious Sects*; and many outlandiſh Phraſes, which ſeveral *Writers*, and *Tranſlators*, in that great Hurry, brought in, and made free as they pleas'd, and withal it was inlarg'd by many ſound and neceſſary Forms and Idioms, which it before wanted. And now, when Men's Minds are ſomewhat ſettled, their Paſſions allay'd, and the peace of our Country gives us the Opportunity of ſuch Diverſions; if ſome ſober and judicious Men would take the whole Maſs of our Language into their Hands, as they find it, and would ſet a Mark on the ill Words, correct thoſe which are to be retain'd, admit and eſtabliſh the good, and make ſome Emendations in the Accent and Grammar: I dare pronounce, that our *Speech* would quickly arrive at as much Plenty, as it is capable to receive; and at the greateſt Smoothneſs, which its Derivation from the rough *German* will allow it.

Nor would I have this new *Engliſh Academy* confin'd only to the weighing Words and Letters; but there may be alſo greater Works found out for it. By many

many Signs we may gueſs, that the Wits of our Nation are not inferior to any other; and that they have an excellent Mixture of the Spirit of the *French* and the *Spaniard:* and I am confident, that we only want a few more ſtanding Examples, and a little more Familiarity with the Antients to excell all the Moderns. Now the beſt Means that can be deviſ'd to bring that about, is to ſettle a fixt and *impartial Court* of *Eloquence*; according to whoſe Cenſure, all Books, or Authors, ſhould either ſtand or fall. And above all, there might be recommended to them one principal Work, in which we are yet defective; and that is, the compiling of a *Hiſtory* of our late *Civil Wars*. Of all the Labours of Men's Wit and Induſtry, I ſcarce know any that can be more uſeful to the World than *Civil Hiſtory*; if it were written, with that Sincerity and Majeſty, as it ought to be, as a faithful Idea of human Actions. And it is obſervable, that almoſt in all civiliſ'd Countries, it has been the laſt thing, that has come to Perfection. I may now ſay, that the *Engliſh* can already ſhew many induſtrious and worthy Pieces in this kind: But yet, I have ſome prophetical Imagination in my Thoughts, that there is ſtill behind ſomething greater than any we have yet ſeen, reſerv'd for the Glory of this Age. One Reaſon of this my ſtrong Perſuaſion is a Compariſon, that I make, between the Condition of our *State*, and that of the *Romans*. They at firſt wrote, in this way, not much better than our *Monks:* only regiſtring, in an undigeſted manner, ſome few naked Breviaries of their Wars, and Leagues, and Acts of their City Magiſtrates. And indeed they advanc'd forward by very ſlow Degrees: For I remember, that *Tully* ſomewhere complains, in theſe

Words: *Hiſtoria nondum Latinis Literis illuſtrata.* But it was the peaceful Reign of *Auguſtus*, after the Concluſion of their long Civil Wars, the moſt of their perfect *Hiſtorians* appear'd. And it ſeems to me, that we may expect the ſame Progreſs amongſt us. There lye now ready in Bank the moſt memorable Actions of twenty Years; a Subject of as great Dignity and Variety, as ever paſs'd under any Man's Hands; the Peace which we enjoy, gives Leiſure and Encouragement enough; the Effects of ſuch a Work would be wonderfully advantageous to the Safety of our Country, and to *His Majeſty*'s Intereſt: for there can be no better Means to preſerve his Subjects in Obedience for the future, than to give them a full View of the Miſeries that attend Rebellion. There are only therefore wanting for the finiſhing of ſo brave an Undertaking, the united Endeavours of ſome publick Minds, who are converſant both in Letters and Buſineſs: and if it were appointed to be the Labour of one or two Men to compoſe it, and of ſuch an *Aſſembly* to reviſe and correct it, it might certainly challenge all the Writings of paſt or preſent Times.

But, I ſee, I have already tranſgreſs'd: for I know it will be thought unadviſedly done, while I was inforcing a weightier Deſign, to ſtart, and to follow another of leſs Moment. I ſhall therefore let it paſs as an extravagant Conceit: only I ſhall affirm, that the *Royal Society* is ſo far from being like to put a Stop to ſuch a Buſineſs, that I know many of its Members, who are as able as any others, to aſſiſt in the bringing it into Practice.

Thus I have diſpatch'd my firſt general Head; in which, it may be, it was not needful to have ſtaid ſo

long; seeing, I am confident, I have said nothing, but what was before very well known, and what passes about in common Discourse.

I did on purpose omit the *learned Age* of the *Arabians*, in its proper Place; because I was resolved, as I came down, to keep my self as near as I could, within the Bounds of *Christendom*. But I shall now add, concerning them, that their Studies also were principally bent upon expounding *Aristotle*, and the *Greek Physicians*. They were, without Question, Men of a deep and subtile Wit; which is a Character, that (it may be) in all Ages has belonged more justly to the Tempers of the Southern, than of the Northern Countries. Of this they have left many noble Testimonies behind them; so many, that (if we believe some worthy and industrious Men of our own Nation, who have searched into their Monuments) they might even almost be compared to *Rome* and *Athens* themselves. But they enjoyed not the Light long enough: It brake forth upon the Point of their greatest Conquests; it mainly consisted, in understanding the Ancients; and what they would have done, when they had been weary of them we cannot tell: For that Work was not fully over, before they were darkened by that, which made even *Greece* it self barbarous, the *Turkish Monarchy*. However, that Knowledge, which they had, is the more remarkable, because it sprang up, in that Part of the World, which has been almost always perversly unlearned. For methinks, that small Spot of civil Arts, compared to their long Course of Ignorance, before and after, bears some Resemblance with that Country it self; where there are some few little Vallies, and Wells,

Sect. XXI. *The Philosophy of the Arabians.*

Wells, and pleaſant Shades of *Palm-Trees*; but thoſe lying in the midſt of Deſerts, and unpaſſable Tracts of Sands.

Sect. XXII. *A Defence of the Royal Society, in reſpect of the Ancients.*

But now it being a fit Time to ſtop, and breathe a while, and take a Review of the Ground, that we have paſſed. It would be here needful for me to make an Apology for my ſelf, in a Matter, which, if it be not beforehand remov'd, may chance to be very prejudicial to Men's good Opinion of the *Royal Society* itſelf, as well as of its *Hiſtorian*. I fear, that this *Aſſembly* will receive Diſadvantage enough, from my weak Management of their Cauſe, in many other Particulars; ſo that I muſt not leave them, and myſelf unjuſtified, in this, wherein we have ſo much Right on our Sides. I doubt not then, but it will come into the Thoughts of many *Criticks* (of whom the World is now full) to urge againſt us, that I have ſpoken a little too ſparingly of the Merits of former Ages; and that this Deſign ſeems to be promoted, with a malicious Intention of diſgracing the Merits of the *Ancients*.

But firſt, I ſhall beſeech them, calmly to conſider; whether they themſelves do not more injure thoſe great Men, whom they would make the Maſters of our Judgments, by attributing all Things to them ſo abſolutely; than we, who do them all the Juſtice we can, without adoring them? It is always eſteemed the greateſt Miſchief a Man can do thoſe whom he loves, to raiſe Men's Expectations of them too high, by undue and impertinent Commendations. For thereby not only their Enemies, but indifferent Men, will be ſecretly inclined to be more watchful over their Failings, and to conſpire in beating down their

Fame. What then can be more dangerous to the Honour of Antiquity; than to ſet its Value at ſuch a Rate, and to extol it ſo extravagantly, that it can never be able to bear the Trial, not only of envious, but even of impartial Judges? It is natural to Men's Minds, when they perceive others to arrogate more to themſelves, than is their Share; to deny them even that, which elſe they would confeſs to be their Right. And of the Truth of this, we have an Inſtance of far greater Concernment, than that which is before us: And that is, in *Religion* itſelf. For while the *Biſhops* of *Rome* did aſſume an Infallibility, and a ſovereign Dominion over our Faith; the *reformed Churches* did not only juſtly refuſe to grant them that, but ſome of them thought themſelves obliged to forbear all Communion with them, and would not give them that Reſpect, which poſſibly might belong to ſo ancient and ſo famous a *Church*; and which might ſtill have been allowed it, without any Danger of Superſtition.

But to carry this Diſpute a little farther; what is this, of which they accuſe us? They charge us with Immodeſty in neglecting the Guidance of wiſer and more diſcerning Men, than our ſelves. But is not this rather the greateſt Sign of Modeſty, to confeſs, that we our ſelves may err, and all Mankind beſides? To acknowledge the Difficulties of Science; and to ſubmit our Minds to all the leaſt Works of Nature? What kind of Behaviour do they exact from us in this Caſe? That we ſhould reverence the Footſteps of *Antiquity?* We do it moſt unanimouſly. That we ſhould ſubſcribe to their Senſe, before our own? We are willing, in Probabilities; but we cannot, in Matters of Fact; for in them we follow the moſt ancient

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Author of all others, even *Nature* it ſelf. Would they have us make our Eyes behold Things, at no farther Diſtance, than they ſaw? That is impoſſible; ſeeing we have the Advantage of ſtanding upon their Shoulders. They ſay, it is Inſolence, to prefer our own Inventions before thoſe of our *Anceſtors*. But do not even they the very ſame Thing themſelves, in all the pretty Matters of Life? In the 'Arts of War, and Government; in the making, and aboliſhing of Laws; nay even in the Faſhion of their Cloaths, they differ from them, as their Humour or Fancy leads them. We approach the Ancients, as we behold their Tombs with Veneration; but we would not therefore be confined to live in them altogether; nor would (I believe) any of thoſe, who profeſs to be more addicted to their Memories. They tell us, that in this Corruption of Manners, and Sloth of Men's Minds, we cannot go beyond thoſe, who ſearched ſo diligently, and concluded ſo warily before us. But in this they are confuted by every Day's Experience. They object to us *Tradition*, and the Conſent of all Ages. But do we not yet know the Deceitfulneſs of ſuch Words? Is any Man, that is acquainted with the Craft of founding *Sects*, or of managing Votes in *popular Aſſemblies*, ignorant, how eaſy it is to carry Things in a violent Stream? And when an Opinion has once maſter'd its firſt Oppoſers, and ſettled itſelf in Men's Paſſions or Intereſts; how few there be, that coldly conſider, what they admit for a long time after? So that when they ſay, that *all Antiquity* is againſt us, 'tis true, in ſhew, they object to us the Wiſdom of many Ages; but in reality, they only confront us, with the Authority of a few leading Men. Nay, what if I ſhould ſay, that this Honour for

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the dead, which ſuch Men pretend to, is rather a worſhipping of themſelves, than of the *Antients?* It may be well prov'd, that they are more in Love with their own *Commentaries*, than with the *Texts* of thoſe, whom they ſeem to make their Oracles; and that they chiefly doat on thoſe Theories, which they themſelves have drawn from them; which, it is likely, are almoſt as far diſtant from the original Meaning of their *Authors*, as the Poſitions of the *new Philoſophers* themſelves.

But to conclude this Argument (for I am weary of walking in a Road ſo trodden) I think I am able to confute ſuch Men by the Practice of thoſe very *Antients*, to whom they ſtoop ſo low. Did not they truſt themſelves, and their own Reaſons? Did not they buſie themſelves in Inquiry, make new Arts, eſtabliſh new Tenets, overthrow the old, and order all Things as they pleas'd, without any ſervile Regard to their Predeceſſors? The *Grecians* all, or the greateſt Part of them, fetch'd their Learning from *Egypt*; and did they blindly aſſent to all that was taught them by the *Prieſts* of *Iſis* and *Oſiris?* If ſo; then why did they not, together with their Arts, receive all the infinite Idolatries, which their Maſters embrac'd? Seeing it is not to be queſtion'd, but the *Egyptians* deliver'd the Rites of their Religion to Strangers, with as much Solemnity at leaſt, as they did the Myſteries of their *Hieroglyphicks*, or *Philoſophy*. Now then, let *Pythagoras*, *Plato*, and *Ariſtotle*, and the reſt of their wiſe Men, be our Examples, and we are ſafe. When they travell'd into the *Eaſt*, they collected what was fit for their Purpoſe, and ſuitable to the Genius of their Country, and left the Superfluities behind them: They brought home ſome

of their uſeful Secrets; but ſtill counted their worſhiping a Dog, or an Onion, a Cat, or a Crocodile, ridiculous. And why ſhall not we be allow'd the ſame Liberty, to diſtinguiſh, and chooſe what we will follow? Eſpecially, ſeeing in this, they had a more certain Way of being inſtructed by their Teachers, than we have by them: They were preſent on the Place: They learn'd from the Men themſelves, by word of Mouth, and ſo were in a likely Courſe to apprehend all their Precepts aright; whereas we are to take their Doctrines, ſo many hundred Years after their Death, from their Books only, where they are for the moſt part ſo obſcurely expreſs'd, that they are ſcarce ſufficiently underſtood by the *Grammarians*, and *Linguiſts* themſelves, much leſs by the *Philoſophers*.

In few Words therefore, let ſuch Men believe, that we have no Thought of detracting from what was good in former Times: But, on the contrary, we have a mind to beſtow on them a ſolid Praiſe, inſtead of a great, and an empty. While we are raiſing new Obſervations upon Nature, we mean not to aboliſh the old, which were well and judiciouſly eſtabliſh'd by them: No more, than a *King*, when he makes a new Coin of his own, does preſently call in that, which bears the Image of his Father; he only intends thereby to increaſe the current Money of his Kingdom, and ſtill permits the one to paſs, as well as the other. It is probable enough, that upon a freſh Survey, we may find many Things true, which they have before aſſerted; and then will not they receive a greater Confirmation, from this our new and ſevere Approbation, than from thoſe Men, who reſign up their Opinions to their Words only? It is the beſt Way of honouring

nouring them, to ſeparate the certain Things in them, from the doubtful: For that ſhews, we are not ſo much carried towards them, by raſh Affection, as by an unbyaſs'd Judgment. If we would do them the moſt Right, it is not neceſſary we ſhould be perfectly like them in all Things. There are two principal Ways of preſerving the Names of thoſe that are paſt; the one, by *Pictures*; the other, by *Children:* The *Pictures* may be ſo made, that they may far nearer reſemble the Original, than *Children* do their Parents; and yet all Mankind chooſe rather to keep themſelves alive by Children, than by the other. It is beſt for the *Philoſophers* of this Age to imitate the *Antients* as their *Children*; to have their Blood derived down to them; but to add a new Complexion, and Life of their own: While thoſe, that endeavour to come near them in every Line, and Feature, may rather be called their dead *Pictures* or *Statues*, than their *genuine Off-ſpring*.

*The End of the* FIRST PART.

# THE HISTORY OF THE ROYAL SOCIETY.

## *The* SECOND PART.

Sect. I. *The Division of the Narration.*

THUS I am, at length, arrived at the ſecond Part of my Method, the *Narration* itſelf. This I ſhall divide into three Periods of Time, according to the ſeveral Degrees of the *Preparation*, *Growth*, and *complete Conſtitution* of the *Royal Society*.

The firſt ſhall conſiſt of the *firſt Occaſions* of this Model, and the Men, who firſt deviſed to put it in Execution; and ſhall end where they began to make it a formed and *regular Aſſembly*.

The ſecond ſhall trace out their *firſt Attempts*, till they receiv'd the public Aſſiſtance of *Royal Authority*.

The third ſhall deliver what they *have done* ſince they were made a *Royal Corporation*.

It may ſeem perhaps, that in paſſing through the firſt of theſe, I go too far back, and treat of Things, that may appear to be of too private and domeſtick Concernment, to be ſpoken in this publick Way. But if this *Enterprize*, which is now ſo well eſtabliſhed, ſhall be hereafter advantageous to Mankind (as I make no ſcruple to foretel that it will) it

it is but juſt, that future Times ſhould hear the *Names* of its firſt *Promoters:* That they may be able to render particular Thanks to them, who firſt conceived it in their Minds, and practis'd ſome little Draught of it long ago. And beſides, I never yet ſaw an Hiſtorian that was clear from all Affections; that, it may be, were not ſo much to be called *Integrity*, as a ſtoical *Inſenſibility:* Nor can I, more than others, reſiſt my Inclinations, which ſtrongly force me to mention that, which will be for the Honour of that Place, where I received a great Part of my Education. It was therefore ſome Space after the End of the Civil Wars at *Oxford*, in Doctor *Wilkins* his Lodgings, in *Wadham College*, which was then the Place of Reſort for virtuous and learned Men, that the firſt Meetings were made, which laid the Foundation of all this that followed. The *Univerſity* had at that time many Members of its own, who had begun a *free way* of Reaſoning; and was alſo frequented by ſome *Gentlemen* of Philoſophical Minds, whom the Misfortunes of the Kingdom, and the Security and Eaſe of a Retirement amongſt Gown-men, had drawn thither.

Sect. II. *The Meetings at Oxford.*

Their firſt Purpoſe was no more than only the Satisfaction of breathing a freer Air, and of converſing in Quiet one with another, without being ingag'd in the Paſſions and Madneſs of that diſmal Age. And from the Inſtitution of that *Aſſembly*, it had been enough if no other Advantage had come but this: That by this means there was a Race of young Men provided againſt the next Age, whoſe Minds receiving from them their firſt Impreſſions of *ſober* and *generous Knowledge*, were invincibly arm'd againſt all the Inchantments of *Enthuſiaſm*. But what is more, I may

venture to affirm, that it was in good Measure by the Influence which these Gentlemen had over the rest, that the *University* itself, or at least, any Part of its Discipline and Order, was saved from Ruin. And from hence we may conclude, that the same Men have now no Intention of sweeping away all the Honour of Antiquity in this their new Design; seeing they employed so much of their Labour and Prudence in preserving that *most venerable Seat* of ancient Learning, when their shrinking from its Defence would have been the speediest Way to have destroyed it. For the Truth of this, I dare appeal to all unconcerned Men, who knew the Temper of that Place; and especially to those who were my own Cotemporaries there; of whom I can name very many, whom the happy Restoration of the Kingdom's Peace found as well inclined to serve their *Prince* and the *Church*, as if they had been bred up in the most prosperous Condition of their Country. This was undoubtedly so: Nor indeed could it be otherwise; for such *Spiritual Frensies*, which did then bear Rule, can never stand long, before a clear and a *deep Skill* in *Nature*. It is almost impossible, that they, who converse much with the Subtilty of *Things*, should be deluded by such *thick Deceits*. There is but one better Charm in the World, than *real Philosophy*, to allay the Impulses of the *false Spirit*; and that is, the blessed Presence and Assistance of the *true*.

Nor were the good Effects of this Conversation only confined to *Oxford:* But they have made themselves known in their printed Works, both in our own, and in the learned Language, which have much conduc'd to the Fame of our Nation *abroad*, and to the spreading of profitable Light *at home*. This, I trust,

truſt, will be univerſally acknowledg'd, when I ſhall have nam'd the Men. The principal and moſt conſtant of them were Doctor *Seth Ward*, then Lord Biſhop of *Exeter*, Mr. *Boyle*, Dr. *Wilkins*, Sir *William Petty*, Mr. *Matthew Wren*, Dr. *Wallis*, Dr. *Goddard*, Dr. *Willis*, Dr. *Bathurſt*, Dr. *Chriſtopher Wren*, Mr. *Rook*, beſides ſeveral others who join'd themſelves to them, upon Occaſions. Now I have produc'd their Names, I am a little at a ſtand how to deal with them. For, if I ſhould ſay what they deſerve; I fear it would be interpreted Flattery, inſtead of Juſtice: And yet I have now lying in my Sight, the Example of an *Elegant Book*, which I have profeſs'd to admire, whoſe Author ſticks not to make large Panegyricks on the Members of that *Aſſembly*, whoſe *Relation* he writes. But this Precedent is not to be follow'd by a *young Man*, who ought to be more jealous of publick Cenſure, and is not enough confirm'd in the good Liking of the World, to think, that he has ſuch a weighty and difficult Work, as the making of Characters, committed to him. I will therefore paſs by their Praiſes in Silence; though I believe, that what I might ſay of them, would be generally confeſs'd; and that if any ingenuous Man, who knows them, or their Writings, ſhould contradict me, he would alſo go near to gainſay himſelf, and to retract the Applauſes, which he had ſome Time or other beſtow'd upon them.

For ſuch a candid and unpaſſionate Company, as that was, and for ſuch a gloomy Seaſon, what could have been a fitter Subject to pitch upon than *Natural Philoſophy?* To have been always toſſing about ſome *Theological Queſtion*, would have been, to have made that their private Diverſion, the Exceſs of which

which they themſelves diſlik'd in the publick: To have been eternally muſing on *Civil Buſineſs*, and the Diſtreſſes of their Country, was too melancholy a Reflexion: It was *Nature* alone, which could pleaſantly entertain them in that Eſtate. The Contemplation of that, draws our Minds off from paſt, or preſent Misfortunes, and makes them Conquerors over Things, in the greateſt publick Unhappineſs: while the Conſideration of *Men*, and *human Affairs*, may affect us with a thouſand various Diſquiets; *that* never ſeparates us into moral Factions; that gives us room to differ, without Animoſity; and permits us to raiſe contrary Imaginations upon it, without any Danger of a *Civil War*.

Their *Meetings* were as frequent, as their Affairs permitted: their Proceedings rather by Action, than Diſcourſe; chiefly attending ſome particular Trials, in *Chymiſtry* or *Mechanicks:* they had no Rules nor Method fix'd: their Intention was more to communicate to each other their Diſcoveries, which they could make in ſo narrow a Compaſs, than an united, conſtant, or regular Inquiſition. And methinks, their Conſtitution did bear ſome reſemblance to the *Academy* lately begun at *Paris:* where they have at laſt turn'd their Thoughts from *Words* to experimental *Philoſophy*, and perhaps in Imitation of the *Royal Society*. Their Manner likewiſe, is to aſſemble in a private Houſe, to reaſon freely upon the Works of Nature, to paſs Conjectures, and propoſe Problems, on any Mathematical, or Philoſophical Matter, which comes in their Way. And this is an Omen, on which I will build ſome Hope, that as they agree with us in what was done at *Oxford*, ſo they will go on farther, and come by the ſame Degrees, to erect another

another *Royal Society* in *France*. I promiſe for theſe Gentlemen here (ſo well I know the Generoſity of their Deſign) they will be moſt ready to accept their Aſſiſtance. To them, and to all the Learned World beſides, they call for Aid. No difference of *Country*, *Intereſt*, or Profeſſion of *Religion*, will make them backward from taking or affording Help in this Enterprize. And indeed all *Europe*, at this time, have two general Wars, which they ought in Honour to make; the one a *holy*, the other a *philoſophical*: The one againſt the common Enemy of *Chriſtendom*, the other alſo againſt powerful and barbarous Foes, that have not been fully ſubdued almoſt theſe ſix thouſand Years, *Ignorance*, and *falſe Opinions*. Againſt theſe, it becomes us, to go forth in one common Expedition: All civil Nations joining their *Armies* againſt the one, and their *Reaſon* againſt the other; without any petty Contentions about Privileges, or Prudence.

Sect. III. *Their firſt Meetings at* London.

Thus they continued without any great Intermiſſions, till about the Year 1638. But then being call'd away to ſeveral Parts of the Nation, and the greateſt Number of them coming to *London*, they uſually met at *Greſham* College, at the *Wedneſday's*, and *Thurſday's* Lectures of Dr. *Wren*, and Mr. *Rook*; where there join'd with them ſeveral eminent Perſons of their common Acquaintance: The Lord *Viſcount Brouncker*, the now Lord *Brereton*, Sir *Paul Neil*, Mr. *John Evelyn*, Mr. *Henſhaw*, Mr. *Slingsby*, Dr. *Timothy Clarke*, Dr. *Ent*, Mr. *Ball*, Mr. *Hill*, Dr. *Crone*, and diverſe other Gentlemen, whoſe Inclinations lay the ſame way. This Cuſtom was obſerv'd once, if not twice a week, in Term-time, till they were ſcat-

ter'd by the the miſerable Diſtractions of that fatal Year; till the Continuance of their Meetings there might have made them run the Hazard of the Fate of *Archimedes*: For then the place of their Meeting was made a *Quarter* for *Soldiers*. But, to make haſte through thoſe dreadful Revolutions, which cannot be beheld upon Paper without Horror, unleſs we remember, that they had this one happy Effect, to open Men's Eyes to look out for the true Remedy; upon this follow'd the *King's* Return; and that wrought by ſuch an admirable Chain of Events, that if we either regard the *Eaſineſs*, or *Speed*, or *bleſſed Iſſue* of the Work, it ſeems of itſelf to contain Variety and Pleaſure enough, to make Recompence for the whole twenty Years Melancholy that had gone before. This I leave to another kind of Hiſtory to be deſcrib'd. It ſhall ſuffice my purpoſe, that Philoſophy had its Share in the Benefits of that glorious Action: For the *Royal Society* had its beginning in the wonderful pacifick Year, 1660. So that if any Conjectures of good Fortune, from extraordinary *Nativities*, hold true, we may preſage all Happineſs to this Undertaking. And I ſhall here join my ſolemn Wiſhes, that as it began in that Time, when our Country was freed from Confuſion and Slavery; ſo it may, in its Progreſs, redeem the Minds of Men from Obſcurity, Uncertainty, and Bondage.

Sect. IV. *The Beginning of the Royal Society.*

Theſe Gentlemen therefore finding the Hearts of their Countrymen inlarg'd by their Joys, and fitted for any noble Propoſition; and meeting with the Concurrence of many worthy Men, who, to their immortal Honour, had follow'd the King in his Baniſhment, Mr. *Erskin*, Sir *Robert Moray*, Sir *Gilbert Talbot*,

*bot*, &c. began now to imagine ſome greater Thing, and to bring out experimental Knowledge from the *Retreats*, in which it had long hid itſelf, to take its Part in the *Triumphs* of that univerſal Jubilee. And indeed Philoſophy did very well deſerve that Reward, having been always Loyal in the worſt of Times: For though the King's Enemies had gain'd all other Advantages; though they had all the Garriſons, and Fleets, and Ammunitions, and Treaſures, and Armies on their ſide; yet they could never, by all their Victories, bring over the Reaſon of Men to their Party.

While they were thus ordering their Platform, there came forth a Treatiſe, which very much haſten'd its Contrivance; and that was a Propoſal by Maſter *Cowley*, of erecting a Philoſophical College. The Intent of it was, that in ſome places near *London*, there ſhould liberal Salaries be beſtowed on a competent Number of Learned Men, to whom ſhould be committed the Operations of Natural Experiments. This Model was every way practicable; unleſs perhaps, in two Things, he did more conſult the Generoſity of his own Mind, than of other Men's: the one was the *Largeneſs of the Revenue*, with which he would have his College at firſt indowed; the other, that he impoſed on his Operators a ſecond Task of great Pains, the *Education of Youth*.

The laſt of theſe is indeed a matter of great Weight; the Reformation of which ought to be ſeriouſly examined by prudent Men. For it is an undeniable Truth, which is commonly ſaid, that there would be Need of fewer Laws, and leſs Force to govern Men, if their Minds were rightly inform'd, and ſet ſtrait, while they were young, and pliable. But

perhaps this Labour is not ſo proper for Experimenters to undergo; for it would not only devour too much of their Time, but it would go near to make them a little more *magiſterial* in Philoſophy, than became them; by being long accuſtomed to command the Opinions, and direct the Manners, of their Scholars. And as to the other Particular, the large Eſtate which he required to the Maintenance of his College; it is evident, that it is ſo difficult a Thing to draw Men in to be willing to divert an antient Revenue, which has long run in another Stream, or to contribute out of their own Purſes, to the ſupporting of any new Deſign, while it ſhews nothing but Promiſes, and Hopes; that, in ſuch caſes, it were (it may be) more adviſeable to begin upon a ſmall Stock, and ſo to riſe by degrees, than to profeſs great Things at firſt, and to exact too much Benevolence all in one Lump together. However, it was not the excellent Author's Fault, that he thought better of the Age than it did deſerve. His Purpoſe in it was like himſelf, full of Honour and Goodneſs: Moſt of the other Particulars of his Draught the *Royal Society* is now putting in Practice.

I come now to the ſecond Period of my Narration; wherein I promiſed to give an Account of what they did, till they were publickly owned, encouraged, and confirmed by Royal Favour. And I truſt, that I ſhall here produce many Things, which will prove their Attempts to be worthy of all Men's Incouragement: though what was performed in this Interval may be rather ſtyl'd the *Temporary Scaffold* about the Building, than the *Frame itſelf*. But in my Entrance upon this Part, being come to the Top of the Hill, I begin to tremble, and to apprehend the Greatneſs of

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my Subject. For I perceive, that I have led my Readers Minds on, by so long and so confident a Speech, to expect some wonderful Model, which shall far exceed all the former, that I have acknowledged to have been imperfect. Now, though this were really so, as I believe it is; yet I question, how it will look, after it has been disfigured by my unskilful Hands. But the Danger of this ought to have deterred me in the Beginning: It is now too late to look back; and I can only apply my self to that *good Nature*, which a *great Man* has observed to be so peculiar to our *Nation*, that there is scarce an Expression to signify it, in any other Language. To this I must fly for Succour, and most affectionately intreat my Countrymen, that they would interpret my Failings to be only Errors of Obedience to some, whose Commands, or Desires, I could not resist; and that they would take the Measure of the *Royal Society*, not so much from my lame Description of it, as from the Honour and Reputation of many of those Men, of whom it is composed.

Sect. V. *A Model of their whole Design.*

I will here, in the first place, contract into few Words, the whole *Sum* of their *Resolutions*; which I shall often have occasion to touch upon in *Parcels*. Their Purpose is, in short, to make faithful *Records* of all the Works of *Nature*, or *Art*, which can come within their Reach; that so the present Age, and Posterity, may be able to put a Mark on the Errors, which have been strengthned by long Prescription; to restore the Truths, that have lain neglected; to push on those, which are already known, to more various Uses; and to make the way more passable, to what remains unrevealed. This is the Compass of their Design.

Design. And to accomplish this, they have endeavoured, to separate the Knowledge of *Nature*, from the Colours of *Rhetorick*, the Devices of *Fancy*, or the delightful Deceit of *Fables*. They have labour'd to enlarge it, from being confined to the Custody of a few, or from Servitude to private Interests. They have striven to preserve it from being over-pres'd by a confus'd Heap of vain and useless Particulars; or from being streightned and bound too much up by general Doctrines. They have tried to put it into a Condition of perpetual Increasing; by settling an inviolable Correspondence between the Hand and the Brain. They have studied to make it not only an Enterprise of one Season, or of some lucky Opportunity; but a Business of Time; a steady, a lasting, a popular, an uninterrupted Work. They have attempted, to free it from the Artifice, and Humours, and Passions of Sects: to render it an Instrument, whereby Mankind may obtain a Dominion over *Things*, and not only over one another's *Judgments*: And lastly, they have begun to establish these Reformations in Philosophy, not so much, by any solemnity of Laws, or Ostentation of Ceremonies, as by solid Practice and Examples; not by a glorious Pomp of Words; but by the silent, effectual, and unanswerable Arguments of real Productions.

This will more fully appear, by what I am to say on these four Particulars, which shall make up this Part of my Relation, the *Qualifications* of their *Members*; the *Manner* of their *Inquiry*; their *Weekly Assemblies*; and their *Way* of *Registring*.

Sect. VI. *The Qualifications of the Members of the Royal Society.*

As for what belongs to the *Members* themselves that are to constitute the *Society*: It is to be noted, that

that they have freely admitted Men of different Religions, Countries, and Professions of Life. This they were obliged to do, or else they would come far short of the Largeness of their own Declarations. For they openly profess, not to lay the Foundation of an *English*, *Scotch*, *Irish*, *Popish*, or *Protestant* Philosophy; but a Philosophy of *Mankind*.

*They admit Men of all Religions.*

That the *Church of England* ought not to be apprehensive of this free Converse of various Judgments, I shall afterwards manifest at large. For the present, I shall frankly assert, that our *Doctrine*, and *Discipline*, will be so far from receiving Damage by it; that it were the best Way to make them universally embrac'd, if they were oftner brought to be canvass'd amidst all Sorts of Dissenters. It is dishonourable, to pass a hard Censure on the Religions of all other Countries: It concerns them, to look to the Reasonableness of their Faith; and it is sufficient for us, to be established in the Truth of our own. But yet this Comparison I may modestly make; that there is no one Profession, amidst the several Denominations of Christians, that can be exposed to the Search and Scrutiny of its Adversaries, with so much safety as ours. So equal it is, above all others, to the general Reason of Mankind; such honourable Security it provides, both for the Liberty of Men's Minds, and for the Peace of Government; that if some Men's Conceptions were put in Practice, that all wise Men should have two Religions; the one, a *publick*, for their Conformity with the People, the other, a *private*, to be kept to their own Breasts; I am confident, that most considering Men, whatever their first were, would make ours their second, if they were well acquainted with it. Seeing therefore our Church would be in

so fair a Probability of gaining very much, by a frequent Contention and Encounter with other Sects: It cannot be indangered by this Assembly; which proceeds no farther, than to an unprejudiced Mixture with them.

*Of all Countries.* By their *naturalizing* Men of all Countries, they have laid the Beginnings of many great Advantages for the future. For by this Means, they will be able, to settle a *constant Intelligence*, throughout all civil Nations, and make the *Royal Society* the general *Bank* and Free-port of the World: A Policy, which whether it would hold good in the *Trade* of *England*, I know not; but sure it will in the *Philosophy*. We are to overcome the Mysteries of all the Works of Nature; and not only to prosecute such as are confin'd to one Kingdom, or beat upon one Shore: We should then refuse to list all the Aids, that will come in, how remote soever. If I could fetch my Materials whence I pleas'd, to fashion the *Idea* of a perfect Philosopher; he should not be all of one *Clime*, but have the different Excellencies of several Countries. First, he should have the *Industry*, *Activity*, and *inquisitive Humor* of the *Dutch*, *French*, *Scotch*, and *English*, in laying the ground Work, the Heap of Experiments: And then he should have added the cold, and *circumspect*, and *wary* Disposition of the *Italians* and *Spaniards*, in meditating upon them, before he fully brings them into Speculation. All this is scarce ever to be found in one single Man; seldom in the same Countrymen: It must then be supplied, as well as it may, by a *publick Council*, wherein the various Dispositions of all these Nations may be blended together. To this purpose, the *Royal Society* has made no Scruple to receive all inquisitive

Strangers

Strangers of all Countries into its Number. And this they have conſtantly done, with ſuch peculiar Reſpect, that they have not oblig'd them to the Charge of Contributions; they have always taken Care, that ſome of their Members ſhould aſſiſt them in interpreting all that paſs'd, in their publick Aſſemblies; and they have freely open'd their Regiſters to them; thereby inviting them to communicate foreign Rarities, by imparting their own Diſcoveries. This has been often acknowledg'd by many learned Men, who have travel'd hither; who have been introduc'd to their Meetings, and have admir'd the Decency, the Gravity, the Plainneſs, and the Calmneſs of their Debates. This they have publiſh'd to the World; and this has rous'd all our Neighbours to fix their Eyes upon *England*. From hence they expect the great Improvements of Knowledge will flow; and though, perhaps, they ſend their *Youth* into other Parts to learn *Faſhion*, and *Breeding*; yet their *Men* come hither for nobler Ends, to be inſtructed in the *Maſculine*, and the *ſolid Arts of Life*; which is a Matter of as much greater Reputation, as it is more honourable to teach Philoſophers, than Children.

*Of all Profeſſions.*

By their Admiſſion of Men of all *Profeſſions*, theſe *two* Benefits ariſe: The *one*, that every *Art*, and every Way of Life already eſtabliſh'd, may be ſecure of receiving no Damage by their Counſels. A Thing which all new Inventions ought carefully to conſult. It is in vain to declare againſt the Profit of the moſt, in any Change that we would make. We muſt not always deal with the violent Current of popular Paſſions, as they do with the furious *Eager* in the *Severn*; where the ſafeſt Way is to ſet the Head of the Boat directly againſt its Force. But here Men muſt

follow the Shore; wind about leiſurably; and inſinuate their uſeful Alterations by ſoft and unperceivable Degrees. From the Neglect of this Prudence, we often ſee Men of great Wit, to have been overborn by the Multitude of their Oppoſers; and to have found all their ſubtile Projects too weak for Cuſtom and Intereſt: While being a little too much heated with a Love of their own Fancies, they have raiſed to themſelves more Enemies than they needed to have done, by defying at once too many Things in Uſe. But here this Danger is very well prevented. For what Suſpicion can *Divinity*, *Law*, or *Phyſick*, or any other Courſe of Life have, that they ſhall be impair'd by theſe Men's Labours; when they themſelves are as capable of ſitting amongſt them as any others? Have they not the ſame Security that the whole Nation has for its Lives and Fortunes? Of which this is eſteemed the Eſtabliſhment, that Men of all Sorts and Qualities, give their Voice in every Law that is made in *Parliament*. But the other Benefit is, that by this equal Balance of all Profeſſions, there will no one Particular of them overweigh the other, or make the *Oracle* only ſpeak their *private* Senſe; which elſe it were impoſſible to avoid. It is natural to all Ranks of Men, to have ſome one Darling, upon which their Care is chiefly fixed. If *Mechanicks* alone were to make a Philoſophy, they would bring it all into their Shops, and force it wholly to conſiſt of Springs, and Wheels, and Weights; if *Phyſicians*, they would not depart far from their Art; ſcarce any Thing would be conſidered, beſides the *Body* of *Man*, the *Cauſes*, *Signs*, and *Cures* of Diſeaſes. So much is to be found in Men of all Conditions, of that which is called *Pedantry* in Scholars; which is no-

thing elſe but an obſtinate Addiction to the Forms of ſome private Life, and not regarding general Things enough. This Freedom therefore, which they uſe, in Embracing all Aſſiſtance, is moſt advantageous to them; which is the more remarkable, in that they diligently ſearch out and join to them, all extraordinary Men, though but of ordinary Trades. And that they are likely to continue this comprehenſive Temper hereafter, I will ſhew by one inſtance; and it is the Recommendation which the *King* himſelf was pleaſed to make, of the judicious Author of *the Obſervations on the Bills of Mortality*: In whoſe Election, it was ſo far from being a Prejudice, that he was a Shop-keeper of *London*; that his Majeſty gave this particular Charge to his Society, that if they found any more ſuch Tradeſmen, they ſhould be ſure to admit them all, without any more ado. From hence it may be concluded, what is their Inclination towards the manual Arts; by the careful Regard which their *Founder* and *Patron*, has engag'd them to have for all Sorts of *Mechanick Artiſts*.

Sect. VII. *It conſiſts chiefly of Gentlemen.*

But, though the *Society* entertains very many Men of *particular Profeſſions*, yet the far greater Number are *Gentlemen*, free and unconfin'd. By the Help of this there was hopeful Proviſion made againſt *two Corruptions* of Learning, which have been long complain'd of, but never remov'd: The *one*, that *Knowledge* ſtill degenerates to conſult *preſent Profit* too ſoon; the *other*, that *Philoſophers* have been always *Maſters* and *Scholars*; ſome impoſing, and all the other ſubmitting; and not as equal Obſervers without Dependence.

*The Advantages of this.*

The firſt of theſe may be call'd, the *marrying* of *Arts too ſoon*; and putting them to Generation before they come to be of Age; and has been the Cauſe of much

much Inconvenience. It weakens their Strength; it makes an unhappy Disproportion in their Increase; while not the *best*, but the *most gainful* of them flourish: But above all, it diminishes that very Profit for which Men strive. It busies them about possessing some petty Prize; while Nature itself, with all its mighty Treasures, slips from them; and so they are serv'd like some foolish Guards; who, while they were earnest in picking up some small Money, that the Prisoner drop'd out of his Pocket, let the Prisoner himself escape, from whom they might have got a great Ransom. This is easily declaim'd against, but most difficult to be hindred. If any Caution will serve, it must be this; to commit the Work to the Care of such Men, who, by the Freedom of their Education, the Plenty of their Estates, and the usual Generosity, of noble Blood, may be well suppos'd to be most averse from such sordid Considerations.

The second Error, which is hereby endeavour'd to be remedied, is, that the Seats of Knowledge have been for the most part heretofore, not *Laboratories*, as they ought to be; but only *Schools*, where some have *taught*, and all the rest *subscrib'd*. The Consequences of this are very mischievous. For first, as many *Learners* as there are, so many Hands and Brains may still be reckon'd upon as useless. It being only the *Master*'s part to examine, and observe; and the Disciples, to submit with Silence to what they conclude. But besides this, the very Inequality of the Titles of *Teachers* and *Scholars*, does very much suppress and tame Men's Spirits; which though it should be proper for Discipline and Education; yet is by no means consistent with a free philosophical Consultation. It is undoubtedly true; that scarce any Man's

Mind is so capable of *thinking strongly*, in the Presence of one whom he *fears* and *reverences*, as he is when that Restraint is taken off. And this is to be found, not only in these weightier Matters; but also to give a lighter instance in the Arts of *Discourse* and *Raillery* themselves. For we have often seen Men of bold Tempers, that have over-aw'd and govern'd the Wit of most Companies; to have been disturb'd, and dumb, and bashful as Children, when some other Man has been near, who us'd to out-talk them. Such a kind of natural Sovereignty there is in some Men's Minds over others; which must needs be far greater, when it is advanc'd by long Use, and the *venerable Name* of a *Master*. I shall only mention one *Prejudice* more, and that is this; that from this only Teaching, and Learning, there does not only follow a Continuance, but an Increase of the Yoak upon our Reasons: For those who take their Opinions from others Rules, are commonly stricter Imposers upon their Scholars, than their own Authors were on them, or than the first Inventors of Things themselves are upon others. Whatever the Cause of this be: whether the first Men are made meek and gentle by their long Search, and by better understanding all the Difficulties of Knowledge; while those that learn afterwards, only hastily catching Things in small *Systems*, are soon satisfy'd, before they have broken their Pride, and so become more imperious; or whether it arises from hence, that the same *Meanness of Soul*, which made them bound their Thoughts by other Precepts, makes them also *insolent* to their Inferiors; as we always find *Cowards* the most *cruel*; or whatever other Cause may be alledg'd, the Observation is certain, that the *Successors* are usually more positive and tyrannical, than the *Beginners* of Sects.

It

If then there can be any Cure devis'd for this, it muſt be no other than to form an *Aſſembly* at one Time, whoſe Privileges ſhall be the ſame; whoſe Gain ſhall be in common; whoſe *Members* were not brought up at the Feet of each other. But after all, even this cannot be free from Prevarication in all future Ages. So apt are ſome to diſtruſt, and others to conſide too much in themſelves; ſo much Sweetneſs there is, in leading Parties; ſo much Pride in following a Faction; ſuch various Artifices there are to enſnare Men's *Paſſions*, and ſoon after their *Underſtandings*. All theſe Hazards, and many more, are to be ſuppos'd; which it is impoſſible for mortal Wit wholly to foreſee, much leſs to avoid. But yet we have leſs Ground of Jealouſy from this Inſtitution than any other, not only becauſe they only deal in Matters of *Fact*, which are not ſo eaſily perverted; but alſo upon Security of the Inclinations of the greateſt Part of the *Members* of the *Society* itſelf. This, I hope, moſt Men will acknowledge; and I will take the Permiſſion to ſay in general of them, that in all *paſt* and *preſent* Times, I am confident there can never be ſhewn ſo great a Number of *Cotemporaries* in ſo narrow a Space of the World, that lov'd Truth ſo zealouſly ſought it ſo conſtantly; and upon whoſe Labours Mankind might ſo freely rely. This I ſpeak, not out of Bravery to *Foreigners* (before whoſe Eyes, I believe, this negligent Diſcourſe will never appear) but to the learned Men of this *Nation*, who are better Judges of what I ſay. And this too, I dare affirm, in an *Age*, wherein I expect to be condemn'd of Falſhood or Partiality for this Character, which I have given. For ſo it happens, that we are now arriv'd at that exceſſive cenſuring Humour, that he who takes upon him to commend any thing,

thing, though ever so worthy, will raise to himself far more Enemies than Friends. And indeed this *Sourness* of *Criticism*, which now bears down all before it, is very injurious to the Honour of our Country. For by despising Men for not being absolutely excellent, we keep them from being so; while *Admonitions* joined with *Praises*, and *Reproofs* with *Directions*, would quickly bring all Things to a higher Perfection. But the Rudeness of such *Criticks* I do not so much regard, as the Objections of soberer Men, who have a real good Will to the Promotion of this Design, and yet may be a little dissatisfied in this Place. For here especially they may doubt of two Things; the first, whether the *Royal Society* being so numerous as it is, will not in short Time be diverted from its primitive Purpose; seeing there will be scarce enough Men of philosophical Temper always found to fill it up; and then others will croud in, who have not the same Bent of Mind; and so the whole Business will insensibly be made rather a Matter of Noise and Pomp, than of real Benefit! The second, whether their Number being so large, will not affright private Men from imparting many profitable Secrets to them; lest they should thereby become common, and so they be deprived of the Gain, which else they might be sure of, if they kept them to themselves.

Sect. VIII. *A Defence of the Largeness of their Number.*

To the first I shall reply, That this Scruple is of no Force, in respect of *the Age wherein we live*. For now the Genius of *Experimenting* is so much dispers'd, that even in this *Nation*, if there were one or two more such *Assemblies* settled, there could not be wanting able Men enough to carry them on. All Places and Corners are now busy and warm about this Work: and

and we find many noble Rarities to be every Day given in not only by the Hands of learned and profeſſed Philoſophers; but from the Shops of *Mechanicks*; from the Voyages of *Merchants*; from the Ploughs of *Husbandmen*; from the Sports, the Fiſh-ponds, the Parks, the Gardens of *Gentlemen*; the Doubt therefore will only touch *future Ages*. And even for them too, we may ſecurely promiſe, that they will not, for a long Time, be barren of a Race of inquiſitive Minds, when the Way is now ſo plainly trac'd out before them; when they ſhould have taſted of theſe firſt Fruits, and have been excited by this Example. There was ſcarce ever yet, any the meaneſt Sect, or the moſt contemptible Opinion, that was utterly extinguiſh'd in its Cradle. Whether they deſerv'd to live, or not, they all had their Courſe; ſome longer, ſome ſhorter, according as they could combine with the Intereſts or Affections of the Countries where they began. What Reaſon then have we to bode ill alone to this *Inſtitution*, which is now ſo earneſtly embraced; and which, the older it grows, cannot but ſtill appear more inoffenſive? If we only required *perfect Philoſophers* to manage this Employment, it were another Caſe. For then I grant it were improbable, that threeſcore, or an hundred ſuch ſhould meet in one Time. But here it is far otherwiſe; if we cannot have a ſufficient Choice of thoſe that are skill'd in all *Divine* and *Human* Things (which was the ancient Definition of a Philoſopher) it ſuffices, if many of them be plain, diligent, and laborious Obſervers: ſuch, who though they bring not much Knowledge, yet bring their Hand, and their Eyes uncorrupted: ſuch as have not their Brains infected by falſe Images, and can honeſtly aſſiſt in the *examining* and *regiſtering* what

what the others repreſent to their View. It ſeems ſtrange to me, that Men ſhould conſpire to believe all things more perplexed, and difficult, than indeed they are. This may be ſhewn in moſt other Matters; but in this particular in hand, it is moſt evident, Men did generally think, that no Man was fit to meddle in Matters of this Conſequence, but he that had bred himſelf up in a long Courſe of Diſcipline for that Purpoſe; that had the Habit, the Geſture, the Look of a Philoſopher: Whereas Experience, on the contrary, tells us, that greater Things are produc'd by the *free* way, than the *formal*. This Miſtake may well be compar'd to the Conceit we had of *Soldiers*, in the beginning of the civil Wars. None was thought worthy of that Name, but he that could ſhew his Wounds, and talk aloud of his Exploits in the *Low Countries*: Whereas the whole Buſineſs of fighting, was afterwards chiefly perform'd by *untravel'd Gentlemen, raw Citizens*, and *Generals* that had ſcarce ever before ſeen a Battle. But to ſay no more, it is ſo far from being a Blemiſh, that it is rather the Excellency of this Inſtitution, that *Men of various Studies* are introduced. For ſo there will be always many ſincere Witneſſes ſtanding by, whom Self-love will not perſuade to report falſly, nor Heat of Invention carry to ſwallow a Deceit too ſoon; as having themſelves no Hand in the making of the Experiment, but only in the *Inſpection*. So cautious ought Men to be, in pronouncing even upon Matters of Fact. The whole Care is not to be truſted to *ſingle* Men; not to a *Company* all of *one Mind*; not to *Philoſophers*; not to *devout* and religious Men *alone*: By all theſe we have been already deluded; even by thoſe whom I laſt named, who ought moſt of all to abhor Falſhood; of whom yet many have mul-

tiplied upon us infinite Stories and falſe Miracles, without any regard to Conſcience or Truth.

To the ſecond Objection I ſhall briefly anſwer; that if all the Authors, or Poſſeſſors of extraordinary Inventions, ſhould conſpire to conceal all that was in their Power from them; yet the *Method* which they take will quickly make abundant Reparation for that Defect. If they cannot come at Nature in its particular *Streams*, they will have it in the *Fountain*. If they could be ſhut out from the Cloſets of *Phyſicians*, or the Work-houſes of *Mechanicks*; yet with the ſame, or with better Sorts of Inſtruments, on more Materials, by more Hands, with a more rational Light, they would not only reſtore again the old Arts, but find out perhaps many more of far greater Importance. But I need not lay much Streſs upon that Hope; when there is no Queſtion at all, but all, or the greateſt part of ſuch *domeſtick Receipts* and Curioſities, will ſoon flow into this *publick Treaſury*. How few Secrets have there been, though ever ſo gainful, that have been long conceal'd from the whole World by their *Authors?* Were not all the leaſt Arts of Life at firſt private? Were not *Watches*, or *Locks*, or *Guns*, or *Printing*, or lately the *Bow-dye*, devis'd by *particular Men*, but ſoon made *common?* If neither *Chance*, nor *Friendſhip*, nor *Treachery* of Servants, have brought ſuch Things out; yet we ſee *Oſtentation* alone to be every Day powerful enough to do it. This Deſire of Glory, and to be counted *Authors*, prevails on all, even on many of the dark and reſerv'd *Chymiſts* themſelves; who are ever printing their greateſt Myſteries, though indeed they ſeem to do it with ſo much Reluctancy, and with a Willingneſs to hide ſtill; which makes their *Style* to reſemble the *Smoke*, in which they deal.

deal. Well then, if this Diſpoſition be ſo *univerſal*, why ſhould we think, that the Inventors will be only tender and backward to the *Royal Society*; from which they will not only reap the moſt *ſolid Honour*, but will alſo receive the ſtrongeſt Aſſurances of ſtill retaining the *greateſt part of the Profit?* But if all this ſhould fail, there ſtill remains a Refuge, which will put this whole Matter out of Diſpute: and that is, that the *Royal Society* will be able by Degrees to purchaſe ſuch extraordinary Inventions, which are now cloſe lock'd up in *Cabinets*; and then to bring them into one common Stock, which ſhall be upon all occaſions expos'd to all Men's Uſe. This is a moſt *heroick Intention*: For by ſuch Concealments, there may come very much Hurt to Mankind. If any certain Remedy ſhould be found out againſt an *Epidemical* Diſeaſe; if it were ſuffer'd to be ingroſs'd by one Man, there would be great Swarms ſwept away, which otherwiſe might be eaſily ſav'd. I ſhall inſtance in the *Sweating-Sickneſs*. The *Medicine* for it was almoſt infallible: But, before that could be generally publiſh'd, it had almoſt diſpeopled whole Towns. If the ſame Diſeaſe ſhould have return'd, it might have been again as deſtructive, had not the Lord *Bacon* taken Care, to ſet down the particular Courſe of *Phyſick* for it, in his Hiſtory of *Henry the Seventh*, and ſo put it beyond the Poſſibility of any private Man's invading it. This ought to be imitated in all other *ſovereign Cures* of the like Nature, to avoid ſuch dreadful Caſualties. The *Artificers* ſhould reap the common Crop of their *Arts*; but the *Publick* ſhould ſtill have *Title* to the miraculous Productions. It ſhould be ſo appointed, as it is in the Profits of Men's Lands; where the Corn, and Graſs, and Timber, and ſome coarſer Metals belong to the

*Owner:* But the *Royal Mines*, in whoſe Ground ſoever they are diſcovered, are no Man's Propriety, but ſtill fall to the *Crown*.

Theſe therefore are the *Qualities* which they have principally required in thoſe whom they admitted; ſtill reſerving to themſelves a Power of *increaſing*, or keeping to their Number, as they ſaw Occaſion. By this means, they have given Aſſurance of an eternal Quietneſs and Moderation, in their experimental Progreſs; becauſe they allow themſelves to differ in the weightieſt Matter, even in the *Way of Salvation* itſelf. By this they have taken Care, that nothing ſhall be ſo remote as to eſcape their Reach; becauſe ſome of their *Members* are ſtill ſcattered abroad, in moſt of the habitable Parts of the Earth. By this they have provided, that no profitable Thing ſhall ſeem too mean for their Conſideration, ſeeing they have ſome amongſt them, whoſe Life is employed about *little* Things, as well as *great*. By this they have broken down the Partition-wall, and made a fair Entrance, for *all Conditions of Men* to engage in theſe Studies: which were heretofore affrighted from them, by a groundleſs Apprehenſion of their Chargeableneſs and Difficulty. Thus they have formed that *Society*, which intends a *Philoſophy*, for the Uſe of *Cities*, and not for the Retirements of *Schools*, to reſemble the *Cities* themſelves; which are compounded of all Sorts of Men, of the *Gown*, of the *Sword*, of the *Shop*, of the *Field*, of the *Court*, of the *Sea*; all mutually aſſiſting each other.

Sect. IX. *Their Courſe of Inquiry.*

Let us next conſider what *Courſe of Inquiry* they take, to make all their Labours unite for the Service of Mankind: And here I ſhall inſiſt on their *Expence*, their *Inſtruments*, their *Matter*, and their *Method*.

Of the Stock, upon which their *Expence* has been hitherto defrayed, I can ſay nothing that is very *magnificent*; ſeeing they have relied upon no more than ſome ſmall *Admiſſion-money*, and *weekly Contributions* amongſt themſelves. Such a *Revenue* as this can make no great Sound, nor amount to any *vaſt Sum*. But yet I ſhall ſay this for it, that it was the only way which could have been begun, with a Security of Succeſs, in that Condition of Things. The *publick Faith* of *experimental Philoſophy*, was not then ſtrong enough, to move Men and Women of all Conditions, to bring in their Bracelets and Jewels, towards the carrying of it on. Such Affections as thoſe may be raiſed by a miſguided Zeal; but ſeldom, or never, by calm and unpaſſionate Reaſon. It was therefore well ordained, that the firſt Benevolence ſhould come from the *Experimenters themſelves*. If they had ſpeedily at firſt called for *mighty Treaſures*; and ſaid aloud, that their Enterprize required the *Exchequer of a Kingdom*; they would only have been contemn'd as vain *Projectors*. So ready is Mankind to ſuſpect all new Undertakings to be Cheats, and *Chimæras*; eſpecially, when they ſeem *chargeable*; that it may be, many excellent Things have been loſt by that Jealouſy. Of this we have a fatal Inſtance amongſt our ſelves. For it was this fear of being circumvented, that made one of our wiſeſt *Kings* delay *Columbus* too long, when he came with the Promiſe of a *new World*; whereas a little more Confidence in his *Art*, and a ſmall Charge in furniſhing out ſome few Ships, would have yearly brought all the Silver of the *Weſt-Indies* to *London*, which now arrives at *Sevil*. *Their Expence.*

This Suſpicion, which is ſo natural to Men's Breaſts, could

could not any way harm the *Royal Society's* Eſtabliſhment; ſeeing its firſt Claims and Pretenſions were ſo modeſt. And yet I ſhall preſume to aſſure the World; that what they ſhall raiſe on theſe mean Foundations, will be more anſwerable to the *Largeneſs* of their Intentions, than to the *Narrowneſs* of their Beginnings. This I ſpeak ſo boldly, not only becauſe it is almoſt generally found true; that thoſe Things, which have been *ſmall* at firſt, have oftner grown *greater*, than thoſe which have begun upon a wider Bottom, which have commonly *ſtood at a Stay:* But alſo in reſpect of the preſent prevailing *Genius* of the *Engliſh* Nation. It is moſt uſually found, that every People has ſome one Study or other in their View, about which their Minds are moſt intent, and their Purſes readier to open. This is ſometimes a Profuſion in *Habit* and *Diet*; ſometimes *religious Buildings*; and ſometimes the *civil Ornaments* of their Cities and Country. The firſt of theſe will ſhortly vaniſh from amongſt us, by the irreſiſtible Correction of the King's own Example; the *next* is of late Years very ſenſibly abated: and it is the *laſt* of the three towards which Men's Deſires are moſt propenſe. To evidence this; I think it may be calculated, that ſince the *King*'s return, there have been more *Acts* of *Parliament*, for the *clearing* and *beautifying* of Streets, for the *repairing* of *High-ways*, for the *cutting* of *Rivers*, for the *increaſe* of *Manufactures*, for the ſetting on foot the Trade of Fiſhing, and many other ſuch publick Works, to adorn the State, than in diverſe Ages before. This *general Temper* being well weigh'd, it cannot be imagined, that the *Nation* will withdraw its Aſſiſtance from the *Royal Society* alone; which does not intend to ſtop at ſome *particular Benefit*, but goes to the Root

of

of *all noble Inventions*, and propoſes an infallible Courſe to make *England* the Glory of the Weſtern World.

This my Love and my Hopes prompt me to ſay. But beſides this, there is one Thing more, that perſuades me, that the *Royal Society* will be *immortal*, and that is, that if their Stock ſhould ſtill continue narrow, yet even upon that, they will be able to free themſelves from all Difficulties, and to make a conſtant Increaſe of it, by their managing. There is ſcarce any thing has more hindred *the true Philoſophy*, than a vain Opinion, that Men have taken up, that Nothing could be done in it, to any purpoſe, but upon a *vaſt Charge*, and by a *mighty Revenue*. Men commonly think, that the *Pit*, in which (according to *Democritus*) Truth lyes hid, is bottomleſs; and that it will devour, whatever is thrown into it, without being the fuller. This falſe Conception had got ſo much Ground, that as ſoon as a Man began to put his Hands to *Experiments*, he was preſently given over, as impoveriſhed and undone. And indeed the Enemies of real Knowledge, had ſome Appearance of Reaſon to conclude this heretofore; becauſe they had ſeen the great Eſtates of ſome *Chymiſts* melted away, without any Thing left behind, to make Recompence. But this Imagination can now no longer prevail: Men now underſtand, that Philoſophy needs not ſo great a Prodigality to maintain it; that the moſt *profitable* Trials are not always the moſt *coſtly*; that the beſt Inventions have not been found out by the *richeſt*, but by the moſt *prudent* and *induſtrious* Obſervers; that the right *Art* of *Experimenting*, when it is once ſet forward, will go near to ſuſtain itſelf. This I ſpeak, not to ſtop Men's future Bounty, by a philoſophical Boaſt, that

that the *Royal Society* has enough already: But rather to encourage them to caſt in more Help; by ſhewing them, what Return may be made from a little, by a wiſe Adminiſtration.

Sect. X. *Their Inſtruments.*

Of the Variety and Excellence of the *Inſtruments*, which it lyes in their Power to uſe, I will give no other Proof, than the wonderful Perfection to which all manual Arts have of late Years arrived. Men now generally underſtand, to employ thoſe very Tools which the *Antients* lent us, to infinite more Works than formerly; they have alſo *of late* devis'd a great Multitude of all Sorts, which were before *unknown*; and beſides we may very well expect, that Time will every Day bring forth *more*. For according as the *Matter* to work upon does abound, the greater Plenty of *Inſtruments* muſt by Conſequence follow; ſuch a Connexion there is between *Inventions*, and the *Means* of inventing, that they mutually increaſe each other.

I might be as large, as I pleaſed, in this Particular; in running through ſome Part of all the innumerable Arts of the *weſtern World*; and it were not difficult to ſhew, that the ordinary Shops of *Mechanicks* are now as full of *Rarities*, as the *Cabinets* of the former *nobleſt Mathematicians*. But I will leave that Subject, which is ſo familiar to all, and chooſe rather to fetch a Confirmation of this, even from thoſe Countries, which (after the Manner of the *Antients*) we call *barbarous*. And in going thither for an Example, I have a farther End. In my foregoing Diſcourſe, I tried to make out the Advantages of the *modern* Times above the *antient*; by following the Progreſs of Learning, down through their Tracts, to which *Scholars*

*lars* usually confine it; I will now also strengthen that Argument, by briefly comparing the Skill and the Works of the *unlearned* Parts of the *present* World with those that are *past*. The antient *Barbarians* then, those *Nations* I mean, who lay without the Circle of those Arts which we admire; the *Gauls*, the *Britains*, the *Germans*, the *Scythians*, have scarce left any Footsteps behind them, to shew that they were rational Men. Most of them were savage in their *Practices*; gross in their *Contrivances*; ignorant of all, that might make Life either safe, or pleasant. Thus it was with them, and this all History speaks with one Voice; whereas the *Barbarians* of our Times (if I may take the Liberty still to use that Word, which the Pride of *Greece* first brought into Fashion) the *Turks*, the *Moors*, the *East-Indians*, and even the *Americans*, though they too are utterly unacquainted with all our Sciences; yet by the Help of an *universal Light*, which seems to overspread this *Age*, are in several *Handicrafts* most ready, and dextrous; insomuch that in some, they can scarce be imitated by the *Europeans* themselves. I shall leave it to any Man to conjecture from hence, which of these two Times has the prerogative; and how much better Helps are probably to be found at this Day, in the most *civil Countries*; when we now find so much Artifice, amongst those our *Cotemporaries*, who only follow *rude*, and *untaught* Nature.

Sect. XI. *Their Matter.*

Of the *Extent* of the *Matter*, about which they have been already conversant, and intend to be hereafter; there can be no better Measure taken, than by giving a *general Prospect* of all the Objects of Men's Thoughts; which can be nothing else but either *God*, or *Men*, or *Nature*.

As for the first, they meddle no otherwise with *divine Things*, than only as the *Power*, and *Wisdom*, and *Goodness* of the *Creator* is display'd in the admirable Order and Workmanship of the Creatures. It cannot be deny'd, but it lies in the *natural Philosopher*'s Hands, best to advance that Part of *Divinity*; which, though it fills not the Mind with such *tender* and *powerful Contemplations*, as that which shews us Man's *Redemption* by a *Mediator*; yet it is by no means to be pass'd by unregarded, but is an excellent Ground to establish the other. This is a *Religion* which is confirm'd by the unanimous Agreement of all Sorts of Worships, and may serve in respect to *Christianity*, as *Solomon*'s Porch to the *Temple*; into the one the *Heathens* themselves did also enter, but into the other, only God's *peculiar People*.

In Men, may be consider'd the *Faculties* and Operations of their *Souls*, the *Constitution of their Bodies*, and the *Works of their Hands*. Of these, the *first* they omit; both because the Knowledge and Direction of them have been before undertaken, by some *Arts*, on which they have no mind to intrench, as the *Politicks*, *Morality*, and *Oratory*; and also because the *Reason*, the *Understanding*, the *Tempers*, the *Will*, the *Passions* of Men, are so hard to be reduc'd to any certain Observation of the *Senses*, and afford so much Room to the *Observers* to falsify or counterfeit; that if such Discourses should be once entertain'd, they would be in Danger of falling into *talking*, instead of *working*, which they carefully avoid. Such Subjects therefore as these they have hitherto kept out. But yet, when they shall have made more Progress in *material* Things, they will be in a Condition of pronouncing more boldly on them too. For though Man's *Soul*

and

and *Body* are not only one *natural Engine* (as ſome have thought) of whoſe Motions of all Sorts, there may be as certain an Account given, as of thoſe of a Watch or Clock; yet by long ſtudying of the *Spirits*, of the *Blood*, of the *Nouriſhment*, of the Parts, of the *Diſeaſes*, of the *Advantages*, of the Accidents which belong to *human Bodies* (all which will come within their Province) there may, without Queſtion, be very near Gueſſes made, even at the more *exalted* and *immediate* Actions of the *Soul*; and that too, without deſtroying its *ſpiritual* and *immortal* Being.

Theſe two Subjects, *God*, and the *Soul*, being only forborn, in all the reſt they wander at their Pleaſure: In the Frame of *Men's Bodies*, the Ways for ſtrong, healthful, and long Life; in the *Arts of Men's Hands*, thoſe that either *Neceſſity*, *Convenience*, or *Delight* have produc'd; in the *Works* of *Nature*, their Helps, their Varieties, Redundancies, and Defects; and in bringing all theſe to the *Uſes* of *human Society*.

Sect. XII. *Their Method of Inquiry.*

In their *Method* of *inquiring*, I will obſerve how they have behav'd themſelves in Things that might be brought within their *own Touch* and *Sight*; and how in thoſe, which are ſo remote, and hard to be come by, that about them they were forc'd to truſt *the Reports of others*.

In the firſt Kind, I ſhall lay it down as their *fundamental Law*, that whenever they could poſſibly get to *handle* the Subject, the *Experiment* was ſtill perform'd by ſome of the *Members* themſelves. The want of this *Exactneſs* has very much diminiſh'd the Credit of former *Naturaliſts*; it might elſe have ſeem'd ſtrange, that ſo many Men of Wit, ſetting ſo many Hands on work, being ſo watchful to catch up all Re-

lations, from Woods, Fields, Mountains, Rivers, Seas, and Lands; and ſcattering their Penſions ſo liberally; ſhould yet be able to collect ſo few Obſervations, that have been judicious or uſeful. But the Reaſon is plain; for while they thought it enough, to be only *Receivers* of others Intelligence; they have either employ'd *ignorant* Searchers, who knew not how to digeſt or diſtinguiſh what they found; or *frivolous*, who always lov'd to come home laden, though it were but with Trifles; or (which is worſt of all) *crafty*, who having perceiv'd the Humours of thoſe that paid them ſo well, would always take care to bring in ſuch Collections as might ſeem to agree with the Opinions and Principles of their *Maſters*, however they did with *Nature* itſelf.

This Inconvenience the *Royal Society* has eſcap'd, by making the whole Proceſs paſs under its own Eyes. And the Task was divided amongſt them, by one of theſe two Ways. Firſt, it was ſometimes referr'd to ſome *particular Men*, to make Choice of what *Subject* they pleaſed, and to follow their own Humour in the *Trial*; the *Expence* being ſtill allow'd from the general Stock. By which Liberty, that they afforded, they had a very neceſſary regard to the Power of *particular Inclinations*; which in all Sorts of *Knowledge* is ſo ſtrong; that there may be numberleſs Inſtances given of Men, who in ſome Things have been altogether *uſeleſs*, and yet in others have had ſuch a vigorous and *ſucceſsful* Faculty, as if they had been born and form'd for them alone.

Or elſe ſecondly, the *Society* itſelf made the Diſtribution, and deputed whom it thought fit for the Proſecution of ſuch or ſuch Experiments. And this they did, either by allotting the *ſame Work* to *ſeveral*

Men, ſeparated from one another; or elſe by *joining* them into *Committees*, (if we may uſe that Word in a philoſophical Senſe, and ſo in ſome Meaſure purge it from the ill Sound which it formerly had.) By this *Union* of *Eyes* and *Hands* there do theſe *Advantages* ariſe. Thereby there will be a full *Comprehenſion* of the Object in *all* its Appearances; and ſo there will be a mutual Communication of the Light of one *Science* to another; whereas *ſingle Labours* can be but as a Proſpect taken upon one ſide. And alſo by this fixing of ſeveral Men's Thoughts upon one Thing, there will be an excellent Cure for that *Defect*, which is almoſt unavoidable in great *Inventors*. It is the Cuſtom of ſuch earneſt and powerful Minds, to do wonderful Things in the *Beginning*; but ſhortly after, to be overborn by the Multitude and Weight of their own Thoughts; then to yield, and cool by little and little; and at laſt grow weary, and even to loath that, upon which they were at firſt the moſt eager. This is the wonted Conſtitution of *great Wits*; ſuch tender things are thoſe exalted Actions of the Mind; and ſo hard it is, for thoſe Imaginations, that can run ſwift and mighty Races, to be able to travel a long and a conſtant Journey. The Effects of this Infirmity have been ſo remarkable, that we have certainly loſt very many *Inventions*, after they have been in part faſhion'd, by the meer *languiſhing* and *negligence* of their *Authors*. For this, the beſt Proviſion muſt be, to join many Men together; for it cannot be imagin'd, that they ſhould be all ſo violent and fiery; and ſo by this mingling of Tempers, the *impetuous* Men not having the whole Burthen on them, may have Leiſure for Intervals to recruit their firſt Heat; and the more *judicious*, who are not ſo ſoon poſſeſs'd with ſuch Raptures, may carry

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on the others ſtrong Conceptions, by ſoberer Degrees, to a full Accompliſhment.

Sect. XIII. *Their way of Inquiry into remote Matters.*

This they have practis'd in ſuch Things whereof the Matter is common, and wherein they may repeat their Labours as they pleaſe. But in *foreign* and *remote* Affairs, their *Intentions* and their *Advantages* do far exceed all others. For theſe they have begun to ſettle a *Correſpondence* through all Countries; and have taken ſuch Order, that in ſhort Time there will ſcarce a Ship come up the *Thames*, that does not make ſome return of *Experiments*, as well as of *Merchandize*.

This their Care of an *univerſal Intelligence* is befriended by *Nature* itſelf, in the Situation of *England*: For, lying ſo as it does, in the Paſſage between the *Northern* Parts of the World and the *Southern*; its *Ports* being open to all Coaſts, and its *Ships* ſpreading their *Sails* in all *Seas*; it is thereby *neceſſarily* made, not only *Miſtreſs* of the *Ocean*, but the moſt proper *Seat* for the Advancement of *Knowledge*. From the *Poſitions* of Countries ariſe not only their ſeveral Shapes, Manners, Cuſtoms, Colours, but alſo their *different Arts* and *Studies*. The *Inland* and *Continent* we ſee do give Laws to Diſcourſe, to Habits, to Behaviour; but thoſe that border upon the *Seas*, are moſt properly ſeated to bring home Matter for *new Sciences*, and to make the ſame Proportion of Diſcoveries above others in the *intellectual* Globe, as they have done in the *Material*.

Upon this Advantage of our Iſland, there is ſo much Streſs to be laid towards the Proſperity of this Deſign, that if we ſhould ſearch through all the World for a perpetual Habitation, wherein the univerſal Philoſophy might ſettle itſelf, there can none be found,

which is comparable to *London*, of all the former, or preſent Seats of Empire. *Babylon*, that was the *Capital City* of the firſt *Monarchy*, was ſituated in a Champion Country, had a clear and uncloudy Air; and was therefore fit enough to promote one part of *natural Knowledge*, the *Obſervations* of the *Heavens*: But it was a Mid-land Town, and regarded not the Traffick of Foreigners, abounding with its own Luxury and Riches. *Memphis* was improper, upon the ſame account; for *Egypt* was a *Land content with its own Plenty*, admitting Strangers, rather to inſtruct them, than to learn any thing from them. *Carthage* ſtood not ſo well for a Reſort for *Philoſophers*, as for *Pirates*; as all the *African* Shore continues at this Day. As for *Rome*, its Fortune was read by *Virgil*; when he ſaid, that *it only ought to excel in the Arts of Ruling*. *Conſtantinople*, though its preſent *Maſters* were not *barbarous*, yet is too much ſhut up by the Straits of the *Helleſpont*. *Vienna* is a Frontier Town, and has no Communication with the *Ocean*, but by a long Compaſs about. *Amſterdam* is a place of Trade, without the Mixture of Men of freer Thoughts. And, even *Paris* itſelf, though it is far to be preferr'd before all the others for the Reſort of learned and inquiſitive Men to it, yet is leſs capable, for the ſame Reaſons for which *Athens* was, by being the Seat of *Gallantry*, the *Arts of Speech*, and *Education*. But it is *London* alone, that enjoys moſt of the other's Advantages without their Inconveniences. It is the Head of a *mighty Empire*, the greateſt that ever commanded the *Ocean*: It is compos'd of *Gentlemen*, as well as *Traders*: It has a large Intercourſe with all the *Earth*: It is, as the *Poets* deſcribe their *Houſe* of *Fame*, a City, where all the Noiſes and Buſineſs in the World do meet; and therefore this Honour

Honour is justly due to it, to be the *constant* place of *Residence* for that *Knowledge*, which is to be made up of the Reports and Intelligence of all Countries.

To this I will add; That we have another Help in our Hands, which almost forces this Crown on the Head of the *English* Nation: and that is, the *noble* and *inquisitive Genius* of our *Merchants*. This cannot be better shewn, than by comparing them with those of that one Country, which only stands in Competition wth us for Trade. The *Merchants* of *England* live honourably in foreign Parts; those of *Holland* meanly, minding their Gain alone: ours converse freely, and learn from all; having in their Behaviour very much of the *Gentility* of the Families, from which so many of them are descended: The others when they are abroad, shew, that they are only a Race of plain *Citizens*, keeping themselves most within their own Cells, and Ware-houses; scarce regarding the Acquaintance of any, but those with whom they traffick. This *Largeness* of ours, and *Narrowness* of their living, does, no doubt, conduce very much to enrich them; and is, perhaps, one of the Reasons that they can so easily under-sell us: But withal it makes ours the most *capable*, as theirs *unfit*, to promote such an *Enterprise*, as this of which I am now speaking. For indeed, the Effects of their several Ways of Life are as different: Of the *Hollanders*, I need say no more, but of the *English Merchants* I will affirm, that in all sorts of Politeness, and Skill in the *World* and *human Affairs*, they do not only excell them, but are equal to any other sort of Men amongst us.

This I have spoken, not to lessen the Reputation of that *industrious People*: But, that I might (if it were possible) inflame their Minds to an Emulation of this Design:

Deſign. They have all things imaginable to ſtir them up; they have the Examples of the greateſt *Wits* of other Countries, who have left their own Homes, to retire thither, for the Freedom of their Philoſophical Studies: They have one Place (I mean the *Hague*) which may be ſoon made the very Copy of a Town in the *New Atlantis*; which for its Pleaſantneſs, and for the Concourſe of Men of all Conditions to it, may be counted, above all others, (except *London*) the moſt advantageouſly ſeated for this Service.

Theſe have been the Privileges and Practices of the *Royal Society*, in Things foreign and native. It would now be needleſs to ſet down all the Steps of their Progreſs about them; how they obſerv'd all the Varieties of *Generations* and *Corruptions*, natural and artificial; all the Increaſings and Leſſenings, Agreements and Oppoſitions of Things; how, having found out a *Cauſe*, they have applied it to many other *Effects*, and the *Effects* to different *Cauſes*; how they are wont to change the Inſtruments, and Places, and Quantities of Matter, according to Occaſions: and all the other Subtilties and Windings of Trial, which are almoſt infinite to expreſs. I ſhall only, in paſſing, touch on theſe two Things, which they have moſt carefully conſulted.

The one is, not to preſcribe to themſelves any certain *Art* of *Experimenting*, within which to circumſcribe their Thoughts; but rather to keep themſelves free, and change their Courſe, according to the different Circumſtances that occur to them in their Operations, and the ſeveral Alterations of the Bodies on which they work. The true *Experimenting* has this one thing inſeparable from it, never to be a *fixed* and *ſettled Art*, and never to be *limited* by conſtant Rules. This, perhaps, may be ſhewn too in other *Arts*; as in

that of Invention, of which, though in *Logick* and *Rhetorick* ſo many Bounds and Helps are given, yet I believe very few have argued or diſcourſed by thoſe *Topicks*. But whether that be unconfin'd, or no, it is certain that *Experimenting* is, like that which is called *Decence* in human Life: which, though it be that, by which all our Actions are to be faſhioned, and though many things may be plauſibly ſaid upon it; yet it is never wholly to be reduced to ſtanding *Precepts*, and may almoſt as eaſily be *obtain'd*, as defin'd.

Their other Care has been, to regard the *leaſt* and the *plaineſt* Things, and thoſe that may appear at *firſt* the moſt *inconſiderable*, as well as the *greateſt Curioſities*. This was viſibly neglected by the *Antients*. The *Hiſtories* of *Pliny*, *Ariſtotle*, *Solinus*, *Ælian*, abounding more with pretty Tales, and fine monſtrous Stories, than ſober and fruitful Relations. If they could gather together ſome extraordinary Qualities of *Stones* or *Minerals*, ſome Rarities of the *Age*, the *Food*, the *Colour*, the *Shapes* of *Beaſts*, or ſome *Virtues* of *Fountains*, or *Rivers*, they thought they had performed the chiefeſt Part of *Natural Hiſtorians*. But this Courſe is ſubject to much Corruption: It is not the true following of *Nature*; for that ſtill goes on in a ſteady Road, nor is it ſo extravagant, and ſo artificial in its Contrivances, as our Admiration, proceeding from our Ignorance, makes it. It is alſo a Way that, of all others, is moſt ſubject to be deceived; for it will make Men inclinable to bend the Truth much awry, to raiſe a ſpecious Obſervation out of it. It ſtops the ſevere Progreſs of *Inquiry*, infecting the Mind, and making it averſe from the true *Natural Philoſophy*: It is like *Romances*, in reſpect of *True Hiſtory*; which,

by multiplying Varities of extraordinary Events and ſurpriſing Circumſtances, makes that ſeem dull and taſteleſs. And, to ſay no more, the very Delight which it raiſes, is nothing ſo ſolid; but, as the Satisfaction of *Fancy*, it affects us a little in the beginning, but ſoon wearies and ſurfeits: Whereas a juſt *Hiſtory* of *Nature*, like the Pleaſure of *Reaſon*, would not be, perhaps, ſo quick and violent, but of far longer Continuance in its Contentment.

Sect. XIV. *Their weekly Aſſemblies.*

Their *Matter* being thus collected, has been brought before their *weekly Meetings*, to undergo a juſt and a full Examination. In them their principal Endeavours have been, that they might enjoy the Benefits of a *mix'd Aſſembly*, which are Largeneſs of Obſervation, and Diverſity of Judgments, without the Miſchiefs that uſually accompany it; ſuch as Confuſion, Unſteadineſs, and the little Animoſities of divided Parties. That they have avoided theſe Dangers for the time paſt, there can be no better Proof than their conſtant Practice; wherein they have perpetually preſerved a ſingular Sobriety of debating, Slowneſs of conſenting, and Moderation of diſſenting. Nor have they been only free from *Faction*, but from the very *Cauſes* and *Beginnings* of it. It was in vain for any Man amongſt them, to ſtrive to prefer himſelf before another; or to ſeek for any great Glory from the Subtilty of his Wit; ſeeing it was the inartificial Proceſs of the *Experiment*, and not the *Acuteneſs* of any Commentary upon it, which they have had in Veneration. There was no Room left, for any to *attempt* to heat their own, or other's Minds, beyond a due Temper; where they were not allowed to expatiate, or amplify, or connect ſpecious Arguments together.

They could not be much exaſperated one againſt another in their Diſagreements, becauſe they acknowledge, that there may be ſeveral Methods of Nature, in producing the ſame Thing, and all equally good; whereas they that contend for Truth by talking, do commonly ſuppoſe that there is but one Way of finding it out. The Differences which ſhould chance to happen, might ſoon be compos'd; becauſe they could not be grounded on Matters of Speculation, or Opinion, but only of Senſe; which are never wont to adminiſter ſo powerful Occaſions of Diſturbance and Contention, as the other. In brief, they have eſcaped the Prejudices that uſe to ariſe from Authority, from Inequality of Perſons, from Inſinuations, from Friendſhips; but above all, they have guarded themſelves againſt themſelves, leſt the Strength of their own Thoughts ſhould lead them into Error; leſt their good Fortune in one Diſcovery ſhould preſently confine them only to one way of Trial; leſt their Failings ſhould diſcourage, or their Succeſs abate their Diligence. All theſe *excellent philoſophical Qualities* they have by long Cuſtom made to become the peculiar Genius of this *Society*; and to deſcend down to their Succeſſors, not only as *circumſtantial Laws*, which may be neglected, or altered, in the Courſe of Time, but as the very *Life* of their Conſtitution; to remain on their Minds, as the *Laws* of *Nature* do in the Hearts of Men; which are ſo near to us, that we can hardly diſtinguiſh, whether they were taught us by Degrees, or rooted in the very Foundation of our Being.

Sect. XV. *The Ceremonies of their Meetings.*

It will not be here ſeaſonable, to ſpeak much of the *Ceremonies* which they have hitherto obſerved in theſe *Meetings*; becauſe they are almoſt the ſame, which

which have been ſince eſtabliſh'd by their *Council*, which we ſhall have a more proper Occaſion to produce hereafter. Let this only be ſaid in brief, to ſatisfy the curious.

The *Place* where they hitherto aſſembled, is *Greſham College*; where, by the Munificence of a Citizen, there have been Lectures for ſeveral *Arts* indowed ſo liberally, that if it were beyond Sea, it might well paſs for an *Univerſity*. And indeed, by a rare Happineſs in the Conſtitution (of which I know not where to find the like Example) the Profeſſors have been from the Beginning, and chiefly of late Years, of the moſt learned Men of the Nation; though the Choice has been wholly in the diſpoſal of Citizens. Here the *Royal Society* has one *publick Room* to meet in, another for a *Repoſitory* to keep their Inſtruments, Books, Rarities, Papers, and whatever elſe belongs to them; making uſe beſides, by Permiſſion, of ſeveral of the other Lodgings, as their Occaſions do require. And, when I conſider the Place itſelf, methinks it bears ſome Likeneſs to their Deſign. It is now a *College*, but was once the Manſion-houſe of one of the *greateſt Merchants* that ever was in *England*: And ſuch a *Philoſophy* they would build; which ſhould firſt wholly conſiſt of *Action* and *Intelligence*, before it be brought into *Teaching* and *Contemplation*.

Their Time is every *Wedneſday*, after the Lecture of the *Aſtronomy* Profeſſor; perhaps, in Memory of the firſt Occaſions of the Rendezvouſes.

Their Elections, perform'd by Balloting; every Member having a Vote; the Candidates being named at one Meeting, and put to the *Scrutiny* at another.

Their *chief Officer* is the *Preſident*; to whom it belongs to call, and diſſolve their *Meetings*; to *propoſe*

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the Subject; to *regulate* the Proceedings; to *change* the Inquiry from one thing to another; to *admit* the Members who are elected.

Besides him, they had at first a *Register*, who was to take Notes of all that passed; which were afterwards to be reduced into their *Journals* and *Register Books*. This Task was first *perform'd* by Dr. *Croone*. But they since thought it more necessary, to appoint two *Secretaries*, who are to reply to all Addresses from Abroad, and at Home; and to publish whatever shall be agreed upon by the *Society*. These are at present, Dr. *Wilkins*, and Mr. *Oldenburgh*, from whom I have not usurp'd this first Imployment of that Kind; for it is only my Hand that goes, the Substance and Direction came from one of them.

This is all that I have to say concerning their *ceremonial Part*. In most other Things, they bounded themselves to no standing Orders, there being nothing more intended in such Circumstances, than Convenience and Order. If any shall imagine, they have not limited themselves to *Forms* enough, to keep up the Gravity, and Solemnity of such an Enterprize, they are to consider, that so much Exactness and Curiosity of Observances, does not so well befit *Inquirers*, as *Sects* of Philosophy, or Places appointed for Education, or those who submit themselves to the Severity of some religious Order. The Work which the *Society* proposes to itself, being not so fine, and easy, as that of Teaching is: but rather a painful digging, and toiling in *Nature*; it would be a great Incumbrance to them, to be streightned to many strict *Punctilios*; as much as it would be to an *Artificer*, to be loaded with many Clothes, while he is labouring in his Shop.

But

But having made ſo much Haſte thro' the *formal Part of theſe their Meetings*, I ſhall not ſo ſoon diſpatch *the ſubſtantial*; which conſiſts in *directing*, *judging*, *conjecturing*, *improving*, *diſcourſing*, upon *Experiments*.

Sect. XVI. *Their directing Experiments.*

Towards the firſt of theſe Ends, it has been their uſual Courſe, when they themſelves appointed the *Trial*, to propoſe one Week ſome particular *Experiments*, to be proſecuted the next; and to debate before Hand, concerning all Things that might conduce to the better carrying them on. In this *preliminary Collection*, it has been the Cuſtom, for any of the *Society*, to urge what came into their Thoughts, or Memories concerning them; either from the Obſervations of others, or from *Books*, or from their own *Experience*, or even from common *Fame* itſelf. And in performing this, they did not exerciſe any great Rigour of chooſing and diſtinguiſhing between *Truths* and *Falſhoods*: but amaſs all together as they came, the certain Works, the Opinions, the Gueſſes, the Inventions, with their different Degrees and Accidents, the Probabilities, the Problems, the general Conceptions, the miraculous Stories, the ordinary Productions, the Changes incident to the ſame Matter in ſeveral Places, the Hindrances, the Benefits, of *Airs*, or *Seaſons*, or *Inſtruments*; and whatever they found to have been begun, to have failed, to have ſucceeded, in the Matter which was then under their Diſquiſition.

This is a moſt neceſſary Preparation, to any that reſolve to make a perfect Search. For they cannot but go blindly, and lamely, and confuſedly about the Buſineſs, unleſs they have firſt laid before them a full Account of it. I confeſs the excellent Monſieur *des Cartes*

*Cartes* recommends to us another Way in his *philoſophical Method*; where he gives this Relation of his own Progreſs; that after he had run through the uſual Studies of Youth, and ſpent his firſt Years in an active Life; when he retired to ſearch into *Truth*, he at once rejected all the *Impreſſions*, which he had before received, from what he had heard and read, and wholly gave himſelf over to a Reflection on the naked *Ideas* of his own Mind. This he profeſs'd to do, that he might lay aſide all his *old Imaginations*, and begin anew to write on a white and unblotted *Soul*. This, perhaps, is more allowable in Matters of *Contemplation*, and in a *Gentleman*, whoſe chief Aim was his own Delight; and ſo it was in his own Choice, whether or no he would go farther to ſeek it, than his own Mind: But it can by no means ſtand with a practical and univerſal *Inquiry*. It is impoſſible, but they, who will only tranſcribe their own Thoughts, and diſdain to meaſure or ſtrengthen them by the Aſſiſtance of others, ſhould be in moſt of their Apprehenſions too narrow, and obſcure; by ſetting down Things for general, which are only peculiar to themſelves. It cannot be avoided, but they will commit many groſs Miſtakes, and beſtow much uſeleſs Pains by making themſelves wilfully *ignorant* of what is already known, and what concealed. It was tried among the *Antients*, to find out the pure and primitive Language of the World, by breeding up a Child ſo, that he might never hear any Man ſpeak. But what was the Event of that Trial? Inſtead of obtaining that End, the Child was made abſolutely dumb thereby. And the like Succeſs will that *Philoſopher* find, who ſhall expect, that, by the keeping his Mind free from the *Tincture* of all other *Opinions*, it will give him the original and uninfected

infected *Truths* of Things. All *Knowledge* is to be got the ſame way that a Language is, by *Induſtry*, *Uſe*, and *Obſervation*. It muſt be receiv'd, before it can be drawn forth. 'Tis true, the Mind of Man is a Glaſs, which is able to repreſent to itſelf, all the Works of *Nature*: But it can only ſhew thoſe Figures, which have been brought before it: It is no *magical Glaſs*, like that with which *Aſtrologers* uſe to deceive the ignorant; by making them believe, that therein they may behold the Image of any *Place*, or *Perſon* in the World, though ever ſo far remov'd from it. I know it may be here ſuggeſted; that they, who buſie themſelves much abroad about learning the Judgments of others, cannot be unprejudic'd in what they think. But it is not the *knowing*, but the peremptory *Addiction* to others *Tenets*, that ſours and perverts the *Underſtanding*. Nay, to go farther; that Man, who is throughly acquainted with all Sorts of *Opinions*, is very much more unlikely, to adhere obſtinately to any one particular, than he whoſe Head is only fill'd with Thoughts, that are all of one Colour.

It being now ſo requiſite, to premiſe this general Collection, it could not be better made, than by the *joint Labours* of the whole *Society*. It were an intolerable Burthen, if it were wholly caſt on the *Experimenters* themſelves. For, it is not only true, that thoſe who have the beſt Faculty of *experimenting*, are commonly moſt averſe from reading Books; and ſo it is fit, that this *Defect* ſhould be ſupplied by other Pains: But alſo it would too much tire, and waſte, or at leaſt divert their Spirits, before they came to the main Work: Whereas the *Task* being ſhar'd amongſt ſo great a Number, will become not much more than a Buſineſs of *Delight*. Well then, by

this first *Comment* and *Discourse* upon the *Experiment*; he that is to try it, being present, and having so good an Opportunity, of comparing so many other Men's Conceptions with his own, and with the *Thing* itself, must needs have his Thoughts more enlarg'd, his Judgment confirm'd, his Eyes open'd to discern, what most compendious Helps may be provided; what part of it is more or less useful, and upon what side it may be best attempted: The *Truths*, which he learns this way, will be his Pattern; the *Errors* will be his Sea-marks, to teach to avoid the same Dangers; the very Falshoods themselves will serve to enlarge, though they do not inform his *Understanding*. And, indeed, a thousand more Advantages will hereby come into the Minds of the most sagacious and acute *Inquirers*, which they would never have compass'd, if they had been only left to themselves. I remember my Lord *Bacon* somewhere says; *That it is one of the greatest Secrets of Nature, that Men's Passions are more capable of being rais'd to higher Degrees in Company, than in Solitude; and that we sooner grieve, fear, rejoice, love, admire, when we behold many others so mov'd, than when we are alone.* This is true; and the same may be as well affirm'd of most other Actions of the Mind. In *Assemblies*, the *Wits* of most Men are *sharper*, their *Apprehensions readier*, their *Thoughts fuller*, than in their *Closets*. Of this there is an undoubted Proof in the *Art of speaking*. For, let the wittiest and most eloquent Men think as largely as they can, on any Subject in private; yet, when they come into the publick, and especially, when they have heard others speak before them, their *Argument* appears quite another thing to them; their former Expressions seem too flat and cold for their present Thoughts;

Thoughts; their Minds ſwell, and are enlightned, as if at that time they were poſſeſs'd with the *Souls* of the whole Multitude, before whom they ſtand.

Sect. VII. *Their judging of the Matter of Fact.*

Thoſe, to whom the Conduct of the *Experiment* is committed, being diſmiſs'd with theſe Advantages, do, as it were, carry the Eyes and the Imaginations of the whole Company into the *Laboratory* with them. And after they have perform'd the *Trial*, they bring all the *Hiſtory* of its *Proceſs* back again to the *Teſt*. Then comes in the ſecond great Work of the *Aſſembly*; which is to *judge* and *reſolve* upon the Matter of *Fact*. In this Part of their Imployment, they us'd to take an exact View of the Repetition of the whole Courſe of the *Experiment*; here they obſerv'd all the *Chances*, and the *Regularities* of the Proceeding; what *Nature* does willingly, what conſtrain'd; what with its own Power, what by the Succours of Art; what in a conſtant Road, and what with ſome kind of Sport and Extravagance; induſtriouſly marking all the various Shapes into which it turns itſelf, when it is purſued, and by how many ſecret Paſſages it at laſt obtains its End; never giving it over till the whole *Company* has been fully ſatisfied of the Certainty and Conſtancy; or, on the other ſide, of the abſolute Impoſſibility of the Effect. This *critical* and *reiterated Scrutiny* of thoſe Things, which are the plain Objects of their Eyes, muſt needs put out of all reaſonable Diſpute the Reality of thoſe Operations, which the *Society* ſhall poſitively determine to have ſucceeded. If any ſhall ſtill think it a juſt *philoſophical Liberty*, to be jealous of reſting on their Credit, they are in the right; and their *Diſſentings* will be moſt thankfully receiv'd, if they be eſtabliſh'd on ſolid Works, and not only on *Prejudices*, or

*Suſpicions*. To the *Royal Society* it will be at any time almoſt as acceptable, to be *confuted*, as to *diſcover*; ſeeing, by this means, they will accompliſh their main *Deſign*: others will be inflam'd; many more will labour; and ſo the *Truth* will be obtain'd between them; which may be as much promoted by the *Contentions* of Hands, and Eyes; as it is commonly injur'd by thoſe of Tongues. However, that Men may not hence undervalue their *Authority*, becauſe they themſelves are not willing to impoſe, and to uſurp a *Dominion* over their *Reaſon*; I will tell them, that there is not any one Thing, which is now approv'd and practis'd in the World, that is confirm'd by ſtronger Evidence, than this which the *Society* requires; except only the *Holy Myſteries of our Religion*. In almoſt all other Matters of *Belief*, of *Opinion*, or of *Science*; the Aſſurance, whereby Men are guided, is nothing near ſo firm, as this. And I dare appeal to all *ſober Men*; whether, ſeeing in all Countries, that are govern'd by Laws, they expect no more, than the Conſent of two or three Witneſſes in Matters of Life and Eſtate; they will not think, they are fairly dealt withal in what concerns their *Knowledge*, if they have the concurring Teſtimonies of *Threeſcore or an Hundred*.

Sect. XVIII. *Their conjecturing on the Cauſes.*

The *Hiſtory* of the *Trial* perform'd being thus ſecur'd, I will next declare, what Room they allow'd for conjecturing upon the *Cauſes*; about which they alſo took ſome Pains, though in a far different Way from the antient *Philoſophers*; amongſt whom, ſcarce any thing elſe was regarded; but ſuch *general Contemplations*. This indeed is the *fatal Point*, about which ſo many of the greateſt *Wits* of all Ages have miſcarried;

ried; and commonly, the greater the Wit, the more has been the Danger: So many wary Steps ought to be trodden in this uncertain Path; ſuch a Multitude of pleaſing *Errors*, falſe *Lights*, diſguiſed *Lies*, deceitful *Fancies* muſt be eſcap'd; ſo much Care muſt be taken to get into the right Way at firſt; ſo much, to continue in it; and at laſt, the greateſt Caution ſtill remaining to be us'd; leſt when the Treaſure is in our View, we undo all, by catching at it too ſoon, with too greedy and raſh a Hand. Theſe and many more are the Difficulties to be paſs'd; which I have here with leſs Apprehenſion reckon'd up, becauſe the Remedy is ſo nigh. To this *Work* therefore the *Society* approaches, with as much Circumſpection and Modeſty, as human Counſels are capable of: They have been cautious, to ſhun the overweening *Dogmatizing* on Cauſes on the one Hand; and not to fall into a *ſpeculative Scepticiſm* on the other; and whatever Cauſes they have with juſt Deliberation found to hold good they ſtill make them increaſe their Benefits, by farther experimenting upon them; and will not permit them to ruſt or corrupt, for want of Uſe. If after all this, they ſhall not ſeem wholly to have remov'd the *Miſchiefs*, that attend this *hazardous Matter*; they ought rather to be judg'd, by what they have done towards it above others, than by what they have not provided againſt; ſeeing the Thing itſelf is of that Nature, that it is impoſſible to place the Minds of Men beyond all Condition of erring about it.

The firſt *Danger* that I ſhall obſerve in this kind, is an *over-haſty*, and *precipitant* concluding upon the *Cauſes* before the *Effects* have been enough ſearch'd into; a finiſhing the *Roof* before the *Foundation* has been well laid. For this, I ſhall firſt alledge this Cure;

that though the *Experiment* was but the private Task of one or two, or ſome ſuch ſmall number; yet the *conjecturing*, and *debating* on its *Conſequences*, was ſtill the Imployment of their full and ſolemn *Aſſemblies*. I have already, upon ſeveral Occaſions, preferr'd *Companies* before *ſingle Endeavours* in *philoſophical* Matters; and yet I am not aſham'd here to repeat it again; eſpecially, ſeeing in this place it is moſt apparent, to which of them the Prerogative of Freedom, and Clearneſs of Judging belongs. To this Purpoſe I ſhall affirm, that there can never be found, in the Breaſt of any particular *Philoſopher*, as much Warineſs, and Coldneſs of Thinking, and rigorous Examination, as is needful, to a ſolid *Aſſent*, and to a laſting *Concluſion*, on the whole Frame of *Nature*. How can it be imagin'd, that any ſingle Mind can comprehend and ſuſtain long enough the Weight of ſo many different *Opinions*, and infinite *Obſervations*; when even the beſt *Mathematicians* are ſoon tir'd with a long Train of the moſt delightful *Propoſitions*, which were before made to their Hands? Or, if there could be a Man of that Vaſtneſs of *Soul*; yet, how can we be aſſur'd, that he would hold the *Scale* even? Where have we ever had an Example of ſo much Streightneſs and Impartiality of Judgment, to perſuade us, that the *calmeſt Philoſopher* will not be inſenſibly inclin'd to prefer his own *Doctrines*, before thoſe of a Stranger? We ſee all the World flatter themſelves in their *Strength*, *Beauty*, nay, even (as ſome have noted) in their very *Statures*; the loweſt Men ſcarce believing, but that they are tall enough. Why then ſhould they be ſingly truſted in their Votes about their own Thoughts; where the Compariſon of Wit makes them more eagerly concern'd? If we follow the *Philoſopher* home into

into his Study, we ſhall quickly diſcover, by how many *plauſible Degrees*, the wiſeſt Men are apt to deceive themſelves into a *ſudden Confidence* of the Certainty of their Knowledge. We will ſuppoſe him to begin his *Inquiry* with all the Sincerity imaginable: reſolving to paſs by no ſmall Miſtake, and to forgive to himſelf no ſlight Error in the *Account*; with theſe *fair Purpoſes*, he pitches on ſome *particular Subject*; this he turns and tortures every way, till, after much Labour, he can make ſome Gueſſes at its *Cauſes*: upon this his Induſtry increaſes; he applies the ſame Matter to ſeveral other Operations; he ſtill finds the Effects anſwer his Expectations: Now he begins to mould ſome *general Propoſition* upon it; he meets with more and more Proofs to confirm his *Judgment*: thus he grows, by little and little, warmer in his *Imaginations*; the Delight of his Succeſs ſwells him; he triumphs and applauds himſelf for having found out ſome *important Truth*: But now his Trial begins to ſlacken; now *Impatience* and *Security* creep upon him; now he careleſly admits whole Crowds of Teſtimonies, that ſeem any way to confirm that *Opinion*, which he had before eſtabliſh'd; now he ſtops his Survey, which ought to have gone forward to many more *Particulars*; and ſo at laſt this *ſincere*, this *invincible Obſerver*, out of Wearineſs, or Preſumption, becomes the moſt negligent in the latter part of his Work, in which he ought to have been the moſt exact. Such is the univerſal Inclination of Mankind, to be miſled by themſelves; which I have mention'd, not to beat down the Credit of any particular *Philoſophers*, whoſe *Superſtructures* have not been anſwerable to the Strength of their firſt *Aſſertions*; but I have only complain'd of it in general, as we uſe to do of Man's Mortality, and being

ing ſubject to Diſeaſes; the aggravating of which common Infirmities can never be eſteem'd by any private Man, as an effect of *Malice* or *ill Nature*.

But now, on the other ſide, this *Doubtfulneſs* of Thoughts, this *Fluctuation*, this *Slowneſs* of concluding, which is ſo uſeful in this Caſe, is ſo natural to a Multitude of Counſellors, that is frequently urg'd againſt them, as their *inſeparable Imperfection*. Every Man has this Argument in his Mouth, wherewith to condemn a great and mixt Number of Adviſers; that their *Deliberations* are ſo tedious, that commonly the *Seaſons of Action* are loſt, before they can come to any Reſult. 'Tis true, this Unweildineſs, and want of Diſpatch, is moſt deſtructive in *Matters of State* and *Government*; as Chriſtendom lately felt: But it has a quite contrary influence on *Philoſophy*. It is not here the moſt ſpeedy, or the ſwifteſt Determination of Thoughts, that will do the Buſineſs: here many Delays are requir'd: here he that can make a *ſolid Objection*, or ask a *ſeaſonable Queſtion*, will do more Good, than he who ſhall boldly fix on a hundred *ill-grounded Reſolutions*. Every Rub is here to be ſmooth'd; every Scruple to be plan'd; every thing to be foreſeen; the Satisfaction of the Reaſon of all paſt, preſent, and future Times to be deſign'd: ſo that here, that which is ſo much cried down in *Policy*, a ſtriving ſtill to do better, can never be too much regarded.

Nor is the *Society* only fore-arm'd againſt this great *Inconvenience*, this Raſhneſs of ſettling upon Cauſes, by the Multitude of Judges that are to be ſatisfied; but alſo by their indifferent hearing of all *Conjectures*, that may be made from the Tenets of any *Sect of Philoſophy*; and by touching every Effect that comes before them, upon all the *Varieties of Opinions*, that

that have been either of late found out, or reviv'd. By this Equality of Reſpect to all Parties, it has allowed a ſufficient Time to ripen whatever it debated: By this too it has made itſelf the common *Cheriſher* and *Umpire* of them all; and has taken the right Way of finding out, what is good in any one of them. A Courſe, which if the Antients had more followed, their Sects would not ſo ſoon have deſtroy'd each other. It was a moſt perverſe Cuſtom amongſt their Diſciples, not to make any *ſtrict Choice*, to leave ſome, and embrace others of their Maſters Doctrines, but to ſwallow all at once. He that became a *Stoick*, an *Epicurean*, a *Peripatetick*, in *Logick*, or *Moral Philoſophy*, or *Phyſicks*, never ſtuck preſently to aſſent to whatever his Founder had ſaid in all the other Sciences; tho' there was no Kind of Connexion between his Doctrines in the one, and the other. Thus was the whole Image of *Philoſophy* formed in their Minds all together: and what they received ſo careleſly, they defended the ſame way; not in Parcels, but in Groſs. Of this the Errors are apparent; for by ſo partially believing all ſorts of Tenets, they had no Time to be fully convinc'd; and ſo became rather *formal* Aſſerters of them, than *judicious*. And by thus adhering to all, without making any Diſtinction between the Truths and Falſhoods, Weakneſſes and Strengths of *their Sects*; they denied to themſelves a far more *calm* and *ſafe Knowledge*, which might have been compounded out of them all, by fetching ſomething from one, and ſomething from another.

This the *Royal Society* did well foreſee; and therefore did not regard the Credit of *Names*, but *Things*: rejecting or approving nothing, becauſe of the Title which it bears; preſerving to itſelf the Liberty of re-

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fuſing or liking, as it found; and ſo advancing its Stock, by a *ſure* and a *double Increaſe*; by adding *new Diſcoveries*, and retaining *antient Truths*. A Largeneſs and Generoſity, which certainly is an excellent *Omen* of its Eſtabliſhment. In this, methinks, it excels any *other Sect*; as the *Roman Commonwealth* did that of *Venice*. The latter began upon a ſmall Stock, and has been careful to preſerve itſelf unmingled, beſtowing the Freedom of its City very ſparingly: And we ſee, it has been ſtill on the defenſive, making no great Progreſs in the World; whereas the *Romans*, by a far more frank and honourable Counſel, admitted all, that deſired to be their Confederates; gave the Liberty of *Roman Citizens* to whole Towns and Countries; excluded none, but thoſe that would *obſtinately* ſtand out; and ſo deſervedly extended their Empire, as far as the Bounds of the *civil World* did reach.

The ſecond Miſchief in this great matter of Cauſes is an *eternal Inſtability* and *Averſion* from aſſigning of any. This ariſes from a violent and imprudent Haſte to avoid the firſt. So eaſy is the Paſſage from one Extreme to another; and ſo *hard* it is to ſtop in that little Point, wherein the Right does conſiſt. The Truth is, they are both almoſt equally pernicious; nothing *ſound* is to be expected from thoſe, who will fix blindly on whatever they can lay hold on; and nothing *great* from them, who will always wander; who will never leave diſputing, whether they dream, or wake, whether there is any Motion, whether they have any Being, or no; the *one* can produce nothing but *unwholſome* and *rotten* Fruits; and the *other*, for Fear of that, will endeavour to have no *Harveſt*, nor *Autumn* at all.

To this Fault of *Sceptical Doubting*, the *Royal Society*

*ciety* may perhaps be ſuſpected to be a little too much inclined; becauſe they always profeſſed to be ſo backward from *ſettling* of *Principles*, or fixing upon *Doctrines*. But if we fairly conſider their Intentions, we ſhall ſoon acquit them. Though they are not yet very daring, in eſtabliſhing Concluſions, yet they lay no Injunctions upon their Succeſſors not to do the ſame, when they ſhall have got a ſufficient Store for ſuch a Work. It is their Study, that the way to attain a *ſolid Speculation* ſhould every Day be more and more purſued; which is to be done by a long forbearing of *Speculation* at firſt, till the Matters be ripe for it; and not by madly ruſhing upon it in the very beginning. Though they do not contemplate much on the *general* Agreements of Things, yet they do on the *particular*; from whence the others alſo will in time be deduc'd. They are therefore as far from being *Scepticks*, as the greateſt *Dogmatiſts* themſelves. The *Scepticks* deny all, both *Doctrines* and *Works*. The *Dogmatiſts* determine on *Doctrines*, without a ſufficient reſpect to *Works*: and this Aſſembly, though we ſhould grant that they have wholly omitted *Doctrines*, yet they have been very poſitive and affirmative in their *Works*. But more than this, it muſt alſo be confeſs'd, that ſometimes after a full Inſpection, they have ventured to give the Advantage of Probability to one Opinion, or Cauſe, above another: Nor have they run any manner of Hazard by thus concluding. For firſt, it is likely, they did hit the *right*, after ſo long, ſo punctual, and ſo gradual an Examination: or if we ſuppoſe the worſt, that they ſhould ſometimes judge *amiſs* (as we cannot but allow they may, ſeeing it will not be juſt to beſtow Infallibility on them alone, while we deny it to all others)

yet they have taken Care, that their *weaker Reasonings*, and even their *Errors*, cannot be very prejudicial to Posterity. The Causes upon which they have agreed, they did not presently extend beyond their due Strength to all other Things, that seem to bear some Resemblance to what they tried. Whatever they have resolved upon, they have not reported as *unalterable Demonstrations*, but as *present Appearances*; delivering down to future Ages, with the good Success of the Experiment, the Manner of their Progress, the *Instruments*, and the several Differences of the *Matter*, which they have applied; so that with their Mistake, they give them also the Means of finding it out. To this I shall add, that they have never affirmed any thing concerning the Cause, till the Trial was past: whereas, to do it before, is a most venomous thing in the making of *Sciences*; for whoever has fixed on his *Cause* before he has experimented, can hardly avoid fitting his *Experiment*, and his Observations, to his own *Cause*, which he had before imagin'd, rather than the *Cause* to the Truth of the *Experiment* itself. But, in a word, they have hitherto made little other Benefit of the *Causes*, to which they have consented, than that thereby they might have a firm footing, whereon new *Operations* may proceed. And for this Work, I mean a Continuation and Variation of the *Inquiry*, the tracing of a *false* Cause doth very often so much conduce, that, in the Progress, the *right* has been discover'd by it. It is not to be question'd, but many Inventions of great Moment have been brought forth by Authors, who began upon Suppositions, which afterwards they found to be untrue. And it frequently happens to *Philosophers*, as it did to *Columbus*; who first believ'd the Clouds, that hover'd about the Continent, to be

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the firm *Land:* But this Miſtake was happy; for, by ſailing towards them, he was led to what he ſought; ſo by proſecuting of miſtaken *Cauſes*, with a Reſolution of not giving over the Purſuit, they have been guided to the *Truth* itſelf.

The laſt Defect is the rendring of Cauſes barren; that when they have been found out, they have been ſuffered to lye idle; and have been only us'd to increaſe Thoughts, and not Works. This Negligence is of all others the moſt dangerous; it is a *Shipwrack* in the end of the *Voyage*, and thence the more to be pitied: It is a Corruption, that both hinders Additions, and eats out the Knowledge that has been already obtained: It is the Fault of *Philoſophers*, and not of meer *Inquirers*; of thoſe that have been *ſucceſsful*, and not of the *unfortunate* in their Search; and therefore it is as the Miſcarriages of thoſe, that are proſperous in human Actions; which are always obſerv'd to be more deſtructive, and harder to be cured, than the Failings of the Afflicted, or thoſe that are ſtill in Purſuit.

Sect. XIX. *Their way of Improving.*

To this the *Royal Society* has applied a double Prevention, both by endeavouring to ſtrike out new *Arts*, as they go along; and alſo, by ſtill improving all to new *Experiments*.

Of the Poſſibility of their performing the firſt, and the Method, which is to be taken about it, I ſhall ſhortly ſpeak in another Place: It is enough here, to ſay, that by this, they have taken Care to ſatisfy the *Hopes* of the *preſent Times*; which elſe might juſtly languiſh, and grow cold about this Enterpriſe; if they once ſaw, that nothing would be ripe in their Days; but that all was to come up hereafter, for the Advantage of thoſe that are yet unborn. They conſulted

the Good of *future* Times, but have not neglected their *own*; they have practis'd both the Parts of *good Husbandry*, planting Trees, and sowing Corn. This latter, for their own speedy Benefit and Support; and the other for the Profit, and Ornament of after-Ages.

Nor have they suffer'd their Diligence to be swallowed up, by the Pleasures and Enjoyments of *present* Discoveries; but have still submitted their noblest Inventions, to be made Instruments and Means for the finding out of *others*. This certainly is the most comprehensive and unerring Method; at once to make use of that Assistance they give, and to force them to be farther helpful to greater Ends. There is nothing of all the Works of Nature so inconsiderable, so remote, or so fully known; but, by being made to reflect on other Things, it will at once enlighten them, and shew itself the clearer. Such is the Dependence amongst all the Orders of Creatures; the inanimate, the sensitive, the rational, the natural, the artificial; that the Apprehension of one of them is a good Step towards the understanding of the rest: And this is the highest Pitch of *human Reason*; to follow all the Links of this Chain, till all their Secrets are open to our Minds, and their Works advanced, or imitated by our Hands. This is truly to command the World; to rank all the *Varieties*, and *Degrees* of Things, so orderly one upon another, that standing on the Top of them, we may perfectly behold all that are below, and make them all serviceable to the Quiet, and Peace, and Plenty of Man's Life. And to this Happiness, there can be nothing else added; but that we make a second Advantage of this *rising Ground*, thereby to look the nearer into Heaven:

An

An Ambition, which though it was punished in the old World by an *universal Confusion*, when it was managed with *Impiety* and *Insolence*; yet, when it is carried on by that *Humility* and *Innocence*, which can never be separated from true Knowledge; when it is designed, not to *brave* the Creator of all Things, but to *admire* him the more; it must needs be the utmost Perfection of *human Nature*.

Sect. XX. *Their manner of Discourse.*

Thus they have directed, judg'd, conjectur'd upon, and improved *Experiments*. But lastly, in these, and all other Businesses, that have come under their Care; there is one thing more, about which the *Society* has been most solicitous; and that is, the manner of their *Discourse*; which, unless they had been very watchful to keep in due Temper, the whole Spirit and Vigour of their *Design* had been soon eaten out, by the Luxury and Redundance of *Speech*. The ill Effects of this Superfluity of Talking, have already overwhelm'd most other *Arts* and *Professions*; insomuch, that when I consider the Means of *happy Living*, and the Causes of their Corruption, I can hardly forbear recanting what I said before; and concluding, that *Eloquence* ought to be banished out of all *civil Societies*, as a thing fatal to Peace and good Manners. To this Opinion I should wholly incline, if I did not find, that it is a Weapon, which may be as easily procur'd by *bad* Men, as *good*; and that, if these should only cast it away, and those retain it; the *naked Innocence* of Virtue would be, upon all Occasions, expos'd to the *armed Malice* of the Wicked. This is the chief Reason, that should now keep up the Ornament of Speaking in any Request, since they are so much degenerated from their original Usefulness. They were at first,

no doubt, an admirable Instrument in the Hands of *wise Men*; when they were only employ'd to describe *Goodness*, *Honesty*, *Obedience*, in larger, fairer, and more moving Images; to represent *Truth* cloath'd with Bodies, and to bring *Knowledge* back again to our very Senses, from whence it was at first deriv'd to our Understandings. But now they are generally chang'd to worse Uses; they make the Fancy disgust the best Things, if they come sound and unadorn'd; they are in open Defiance against *Reason*; professing not to hold much Correspondence with that; but with its Slaves, *the Passions*; they give the Mind a Motion too changeable and bewitching, to consist with *right Practice*. Who can behold, without Indignation, how many Mists and Uncertainties, these specious *Tropes* and *Figures* have brought on our Knowledge? How many Rewards, which are due to more profitable and difficult *Arts*, have been still snatch'd away by the easy Vanity of *fine Speaking!* For now I am warm'd with this just Anger, I cannot with-hold my self, from betraying the Shallowness of all these seeming Mysteries; upon which, we *Writers*, and *Speakers*, look so big. And in few Words, I dare say, that of all the Studies of Men, nothing may be sooner obtain'd, than this vicious Abundance of *Phrase*, this Trick of *Metaphors*, this Volubility of *Tongue*, which makes so great a Noise in the World. But I spend Words in Vain; for the Evil is now so inveterate, that it is hard to know whom to *blame*, or where to begin to *reform*. We all value one another so much, upon this beautiful Deceit; and labour so long after it, in the Years of our Education; that we cannot but ever after think kinder of it, than it deserves. And indeed, in most other Parts of Learning, I look on it to be a Thing almost

moſt utterly deſperate in its Cure; and I think it may be plac'd amongſt thoſe *general Miſchiefs*; ſuch as the *Diſſention* of Chriſtian Princes, the *Want of Practice* in Religion, and the like; which have been ſo long ſpoken againſt, that Men are become inſenſible about them; every one ſhifting off the Fault from himſelf to others; and ſo they are only made bare Common Places of Complaint. It will ſuffice my preſent Purpoſe, to point out, what has been done by the *Royal Society*, towards the correcting of its Exceſſes in *natural Philoſophy*; to which it is, of all others, a moſt profeſt Enemy.

They have therefore been more rigorous in putting in Execution the only Remedy, that can be found for this *Extravagance*; and that has been a conſtant Reſolution, to reject all the Amplifications, Digreſſions, and Swellings of Style; to return back to the primitive Purity and Shortneſs, when Men deliver'd ſo many *Things*, almoſt in an equal Number of *Words*. They have exacted from all their Members, a cloſe, naked, natural way of Speaking; poſitive Expreſſions, clear Senſes; a native Eaſineſs; bringing all Things as near the mathematical Plainneſs as they can; and preferring the Language of Artizans, Countrymen, and Merchants, before that of Wits, or Scholars.

And here, there is one Thing not to be paſs'd by; which will render this eſtabliſh'd Cuſtom of the *Society* well nigh everlaſting; and that is the general Conſtitution of the Minds of the *Engliſh*. I have already often inſiſted on ſome of the Prerogatives of *England*; whereby it may juſtly lay Claim, to be the Head of a *philoſophical League*, above all other Countries in *Europe*: I have urg'd its Situation, its preſent Genius, and the Diſpoſition of its Merchants; and

many more ſuch *Arguments* to encourage us, ſtill remain to be us'd: But of all others, this which I am now alledging, is of the moſt weighty and important Conſideration. If there can be a true Character given of the *univerſal Temper* of any Nation under Heaven; then certainly this muſt be aſcrib'd to our Countrymen; that they have commonly an unaffected Sincerity; that they love to deliver their Minds with a ſound Simplicity; that they have the middle Qualities, between the reſerv'd ſubtile Southern, and the rough unhewn Northern People; that they are not extremely prone to ſpeak; that they are more concern'd what others will think of the Strength, than of the Fineneſs of what they ſay; and that an univerſal Modeſty poſſeſſes them. Theſe Qualities are ſo conſpicuous, and proper to our Soil; that we often hear them objected to us, by ſome of our Neighbour Satyriſts, in more diſgraceful Expreſſions. For they are wont to revile the *Engliſh*, with a want of Familiarity; with a melancholy Dumpiſhneſs; with Slowneſs, Silence, and with the unrefin'd Sullenneſs of their Behaviour. But theſe are only the Reproaches of Partiality, or Ignorance; for they ought rather to be commended for an honourable Integrity; for a Neglect of Circumſtances and Flouriſhes; for regarding Things of *greater* Moment, more than *leſs*; for a Scorn to deceive as well as to be deceived; which are all the beſt Indowments, that can enter into a *philoſophical Mind*. So that even the Poſition of our Climate, the Air, the Influence of the Heaven, the Compoſition of the *Engliſh* Blood; as well as the Embraces of the Ocean, ſeem to join with the Labours of the *Royal Society*, to render our Country a Land of *experimental Knowledge*. And it is a good Sign, that Nature

Nature will reveal more of its Secrets to the *Engliſh*, than to others; becauſe it has already furniſh'd them with a Genius ſo well proportioned, for the receiving and retaining its Myſteries.

Sect. II. *Their way of Regiſtring.*

And now, to come to a Cloſe of the ſecond Part of the *Narration:* The *Society* has reduc'd its principal Obſervations, into one *common Stock*; and laid them up in publick *Regiſters*, to be nakedly tranſmitted to the next Generation of Men; and ſo from them, to their Succeſſors. And as their Purpoſe was, to heap up a mixt Maſs of *Experiments*, without digeſting them into any perfect Model; ſo to this End, they confin'd themſelves to no order of Subjects; and whatever they have recorded. they have done it, not as complete Schemes of Opinions, but as bare unfiniſh'd Hiſtories.

In the Order of their *Inquiſitions*, they have been ſo free, that they have ſometimes committed themſelves to be guided, according to the Seaſons of the Year; ſometimes, according to what any Foreigner, or *Engliſh* Artificer, being preſent, has ſuggeſted; ſometimes, according to any extraordinary Accident in the Nation, or any other Caſualty, which has hapned in their Way. By which roving and unſettled Courſe, there being ſeldom any Reference of one Matter to the next; they have prevented others, nay even their own Hands, from corrupting or contracting the Work; they have made the raiſing of *Rules* and *Propoſitions*, to be a far more difficult *Task*, than it would have been, if their *Regiſters* had been more *Methodical*. Nor ought this Neglect of Conſequence and Order, to be only thought to proceed from their *Careleſsneſs*; but from a mature and well grounded

*Premeditation.* For it is certain, that a too ſudden Striving to reduce the *Sciences*, in their Beginnings, into Method, and Shape, and Beauty, has very much retarded their Increaſe. And it happens to the Invention of Arts, as to Children in their younger Years; in whoſe Bodies, the ſame *Applications*, that ſerve to make them ſtrait, ſlender, and comely, are often found very miſchievous, to their Eaſe, their Strength, and their Growth.

By their fair, and equal, and ſubmiſſive way of *Regiſtring* nothing but *Hiſtories*, and *Relations*; they have left room for others, that ſhall ſucceed, to *change*, to *augment*, to *approve*, to *contradict* them at their Diſcretion. By this, they have given *Poſterity* a far greater Power of judging them, than ever they took over thoſe that went before them. By this, they have made a firm *Confederacy*, between their own *preſent Labours*, and the Induſtry of *future Ages*; which how beneficial it will prove hereafter, we cannot better gueſs, than by recollecting, what Wonders it would in all Likelihood have produc'd e'er this, if it had been begun in the Times of the *Greeks*, or *Romans*, or *Schoolmen*; nay even in the laſt Reſurrection of Learning. What Depth of *Nature* could by this Time have been hid from our View? What Faculty of the Soul would have been in the dark? What Part of human Infirmities not provided againſt? If our Predeceſſors, a thouſand, nay even a hundred Years ago, had begun to add by little and little to the Store, if they would have endeavour'd to be *Benefactors*, and not *Tyrants* over our Reaſons; if they would have communicated to us, more of their *Works*, and leſs of their *Wit*.

This Complaint, which I here take up, will appear the

the juſter, if we conſider, that the firſt *learned Times* of the Antients, and all thoſe, that follow'd after them, down to this Day, would have receiv'd no Prejudice at all; if their *Philoſophers* had chiefly beſtow'd their Pains, in making *Hiſtories of Nature*, and not in *forming* of *Sciences*. Perhaps indeed the Names of ſome particular Men, who had the Luck to compile thoſe *Syſtems* and *Epitomes* which they gave us, would have been leſs glorious than they are: Though that too might be doubted; and (if we may conclude any Thing ſurely, upon a Matter ſo changeable as *Fame* is) we have reaſon enough to believe, that theſe latter Ages would have honour'd *Plato*, *Ariſtotle*, *Zeno*, and *Epicurus*, as much, if not more, than now they do; if they had only ſet Things in a way of propagating Experiences down to us, and not impos'd their *Imaginations* on us, as the only *Truths*. This may be well enough ſuppos'd, ſeeing it is common to all Mankind, ſtill to eſteem dearer the Memories of their *Friends*, than of thoſe that pretend to be their *Maſters*.

But this Matter of *Reputation*, was only the *private* Concernment of five, or ſix. As for the Intereſt of thoſe Times in general, I will venture to make good, that in all Effects of *true Knowledge*, they might have been as happy, without thoſe *Bodies* of *Arts*, as they were with them; *Logick*, and the *Mathematicks* only excepted. To inſtance in their *Phyſicks*; they were utterly uſeleſs, in reſpect of the good of Mankind; they themſelves did almoſt confeſs ſo much, by reſerving their *natural Philoſophy*, for the Retirements of their wiſe Men. What Help did it ever bring to the Vulgar? What viſible Benefit to any City or Country in the World? Their *Mechanicks*, and *Artificers* (for whom

the true *natural Philoſophy* ſhould be principally intended, were ſo far from being aſſiſted by thoſe *abſtruſe Doctrines*; that perhaps ſcarce any one of thoſe Profeſſions, and Trades, has well underſtood *Ariſtotle's Principles of Bodies*, from *his own* Time down to *ours*. Hence then we may conclude, that thoſe *firſt Times*, wherein theſe *Arts* were made, had been nothing damag'd; if, inſtead of raiſing ſo many *ſpeculative Opinions*, they had only minded the laying of a *ſolid Ground-work*, for a vaſt Pile of *Experiments*, to be continually augmenting through all Ages.

And I will alſo add; that, if ſuch a Courſe had been at firſt ſet on Foot, *Philoſophy* would by this means have been kept cloſer to *material Things*; and ſo, in Probability, would not have undergone ſo many *Eclipſes*, as it has done ever ſince. If we reckon from its firſt ſetting forth in the *Eaſt*; we ſhall find, that in ſo long a Tract of Time, there have not been above four or five hundred Years, at ſeveral Intervals, wherein it has been in any Requeſt in the World. And if we look back on all the Alterations and Subverſions of *States*, that have hapned in civil Nations, theſe three thouſand Years; we may ſtill behold, that the *Sciences of Men's Brains*, have been always ſubject to be far more injur'd by ſuch Viciſſitudes, than the *Arts of their Hands*. What Cauſe can be aſſign'd for this? Why was Learning the firſt thing, that was conſtantly ſwept away, in all Deſtructions of Empire, and foreign Inundations? Why could not that have weather'd out the Storm, as well as moſt Sorts of Manufactures; which, though they began as ſoon, or before the other, yet they have remain'd, through all ſuch Changes, unalter'd; except for the better? The Reaſon of this is evident. It is, becauſe *Philoſophy* had been ſpun

out to so fine a Thread, that it could be known but only to those who would throw away all their whole Lives upon it. It was made too subtile for the *common* and *gross* Conceptions of Men of Business. It had before in a measure been banish'd by the Philosophers themselves, out of the World, and shut up in the Shades of their Walks. And by this means, it was first look'd upon as most *useless*, and so fit soonest to be *neglected*. Whereas if at first, it had been made to converse more with the Senses, and to assist familiarly in all Occasions of *human Life*; it would, no doubt, have been thought needful to be preserv'd, in the most *active* and *ignorant* Time. It would have escap'd the Fury of the barbarous People, as well as the Arts of *Ploughing*, *Gardening*, *Cookery*, *Making Iron and Steel*, *Fishing*, *Sailing*, and many more such necessary Handicrafts have done.

And it is too late to lament this Error of the Antients, seeing it is not now to be repair'd. It is enough, that we gather from hence, that by bringing *Philosophy* down again to Men's Sight and Practice, from whence it was flown away so high, the *Royal Society* has put it into a Condition of standing out against the Invasions of *Time*, or even *Barbarism* itself; that by establishing it on a firmer Foundation than the *airy Notions* of Men alone, upon all the *Works of Nature*; by turning it into one of the *Arts* of *Life*, of which Men may see there is daily need; they have provided, that it cannot hereafter be extinguish'd, at the Loss of a Library, at the Overthrowing of a Language, or at the Death of some few *Philosophers*; but that Men must lose their *Eyes* and *Hands*, and must leave off desiring to make their *Lives* convenient or pleasant before they can be willing to *destroy* it.

Thus

Sect. XXI. *The Occasion of the Hindrance of the publishing this History.*

Thus far I was come in my intended *Work*, when my *Hand* was stop'd, and my *Mind* disturb'd from writing, by the two greatest Disasters that ever befel our *Nation*, the *fatal Infection*, which overspread the City of *London* in sixty five, and the *dreadful firing* of the City itself in the Year ensuing. These two Calamities may well be sufficient to excuse the *Delay* of publishing this *Book*; when the one of them devour'd as many *Men*, and the other as many *Books*, as the cruellest Incursion of the *Goths* and *Vandals* had ever done.

The *Plague* was indeed an irreparable Damage to the whole Kingdom; but that which chiefly added to the Misery, was the *Time* wherein it happen'd. For what could be a more deplorable Accident, than that so many *brave Men* should be cut off by the *Arrow that flies in the dark*, when our Country was ingag'd in a *foreign War*, and when their Lives might have been honourably ventur'd on a glorious Theatre in its Defence? And we had scarce recover'd this *first Misfortune*, when we receiv'd a *second* and a deeper Wound; which cannot be equall'd in all *History*, if either we consider the Obscurity of its *Beginning*, the irresistible Violence of its Progress, the Horror of its *Appearance*, or the Wideness of the Ruin it made, in one of the most renown'd *Cities* of the World.

Yet when, on the one side, I remember what *Desolation* these Scourges of Mankind have left behind them; and on the other, when I reflect on the *Magnanimity* wherewith the *English* Nation did support the Mischiefs; I find, that I have not more Reason to *bewail* the one, than to *admire* the other.

Upon

Upon our Return after the abating of the Plague, what elſe could we expect, but to ſee the Streets unfrequented, the *River* forſaken, the *Fields* deform'd with the *Graves* of the *dead*, and the Terrors of *Death* ſtill abiding on the Faces of the living? But inſtead of ſuch diſmal Sights, there appeared almoſt the ſame Throngs in all publick Places, the ſame Noiſe of *Buſineſs*, the ſame Freedom of Converſe, and, with the Return of the *King*, the ſame Chearfulneſs returning on the Minds of the People as before.

Nor was their *Courage* leſs, in ſuſtaining the *ſecond Calamity*, which deſtroyed their *Houſes* and *Eſtates*. This the greateſt Loſers indur'd with ſuch undaunted Firmneſs of Mind, that their Example may incline us to believe, that not only the beſt *natural*, but the beſt *moral* Philoſophy too, may be learn'd from the Shops of Mechanicks. It was indeed an admirable Thing to behold, with what *Conſtancy* the meaneſt Artificers ſaw all the *Labours* of their *Lives*, and the *Support* of their *Families* devoured in an inſtant. The Affliction, it is true, was widely ſpread over the whole Nation; every Place was fill'd with Signs of *Pity* and *Commiſeration*; but thoſe who had ſuffered moſt, ſeem'd the leaſt affected with the Loſs: No *unmanly Bewailings* were heard in the few Streets that were preſerved; they beheld the Aſhes of their *Houſes*, and *Gates*, and *Temples*, without the leaſt Expreſſion of Puſillanimity. If *Philoſophers* had done this, it had well become their Profeſſion of Wiſdom; if Gentlemen, the Nobleneſs of their *Breeding* and *Blood* would have required it: But that ſuch Greatneſs of Heart ſhould be found amongſt the poor *Artizans*, and the obſcure Multitude, is no doubt one of the moſt honourable Events that ever happen'd. Yet ſtill there is one *Circumſtance* be-

hind, which may raiſe our Wonder higher; and that is, that amidſt ſuch horrible *Ruins*, they ſtill proſecuted the *War* with the ſame *Vigour* and *Courage*, againſt three of the moſt powerful States of all *Europe*. What Records of Time, or Memory of paſt Ages, can ſhew us a greater Teſtimony of an invincible and heroick *Genius* than this, of which I now ſpeak? that the Sound of the *Heralds* proclaiming new *Wars* ſhould be pleaſant to the People, when the ſad Voice of the *Bell-man* was ſcarce yet gone out of their Ears? That the Increaſe of their Adverſaries *Confederates*, and of their own *Calamities*, ſhould be ſo far from affrighting them; that they rather ſeem'd to receive from thence a new *Vigour* and *Reſolution?* and that they ſhould ſtill be eager upon *Victories* and *Triumphs*, when they were thought almoſt quite exhauſted, by ſo great Deſtructions?

Sect. XXII. *The third Part of the Narration.*

From this *Obſervation* my Mind begins to take Comfort, and to preſage, that as this *terrible Diſeaſe* and *Conflagration*, were not able to darken the Honour of our *Prince's Arms*; ſo they will not hinder the many noble *Arts*, which the *Engliſh* have begun under his *Reign*, on the Strength of theſe Hopes and Incouragements. I will now return to my former Thoughts, and to the finiſhing of my interrupted *Deſign*. And I come with the more Earneſtneſs to perfect it, becauſe it ſeems to me, that from the ſad Effects of theſe Diſaſters, there may a new and a powerful *Argument* be raiſed, to move us to double our Labours about the *Secrets of Nature*.

A *new* City is to be built, on the moſt advantageous Seat of all *Europe* for Trade and Command. This therefore is the fitteſt Seaſon for Men to apply their Thoughts

Thoughts to the improving of the *Materials* of Building, and to the inventing of better *Models* for *Houſes*, *Roofs*, *Chimnies*, *Conduits*, *Wharfs*, and *Streets*: all which have been already under the Conſideration of the *Royal Society*; and that too, before they had ſuch a ſad Occaſion of bringing their *Obſervations* into Practice. The Mortality of this *Peſtilence* exceeded all others of later Ages; but the Remembrance of it ſhould rather enliven than damp our *Induſtry*. When Mankind is over-run with ſuch horrible Invaſions of *Death*, they ſhould from thence be univerſally alarm'd, to uſe more Diligence about preventing them for the future.

It is true, that terrible *Evil* has hitherto, in all Countries, been generally too ſtrong for the former Remedies of *Art*. But why ſhould we think, that it will continue ſo for ever? Why may we not believe, that in all the vaſt Compaſs of natural Virtues of Things yet conceal'd, there is ſtill reſerv'd an *Antidote*, that ſhall be equal to this Poiſon? If in ſuch Caſes we only accuſe the *Anger* of *Providence*, or the *Cruelty* of *Nature*, we lay the Blame where it is not juſtly to be laid. It ought rather to be attributed to the *Negligence* of Men themſelves, that ſuch *difficult Cures* are without the Bounds of their *Reaſon's Power*.

If all Men had deſponded at firſt, and ſunk under the Burden of their own *Infirmities*, almoſt every little Wound, or Pain of the leaſt *Member*, had been as deadly, as the *Plague* at this time. It was by much Inquiry, and Uſe, that moſt of the mildeſt Diſeaſes became *curable*. And every firſt Succeſs of this kind, ſhould always ſtrengthen our Aſſurance of farther Conqueſts, even over this greateſt Terror of Mankind. Diſtruſt, and Deſpair of our own Endeavours, is as

great Hindrance in the Progreſs of the *true Philoſophy*, as it is wont to be in the Riſe of Men's private Fortunes. Whoever aims not at the greateſt Things, will ſeldom proceed much farther than the leaſt. Whoever will make a right and a fortunate Courtſhip to *Nature*, he cannot enterpriſe or attempt too much: for *She* (as it is ſaid of other *Miſtreſſes*) is alſo a Miſtreſs, that ſooneſt yields to the *forward* and the *bold*.

I have hitherto deſcribed the firſt *Elements*, on which the *Royal Society* aroſe, and ſupported its Beginnings: I have trac'd its Progreſs from the firſt private Endeavours of ſome of its *Members*, till it became united into a *regular Conſtitution*; and from thence I have related their firſt *Conceptions* and *Practices*, towards the ſettling of an univerſal, conſtant, and impartial Survey of the whole *Creation*. There now remains to be added in this third Part of my *Narration*, an Account of the *Incouragements* they have received from abroad, and at home, and a particular Enumeration of the *principal Subjects*, about which they have been employed, ſince they obtain'd the *Royal Confirmation*.

*The Reputation and Correſpondence of the R. S. abroad.*

Sect. XXIII. I will firſt begin with the *Eſteem*, which all the civil World abroad has conceived of their *Enterpriſe*: And I mention this with the more Willingneſs, becauſe I believe that our *Nation* ought juſtly to be reprov'd, for their Exceſs of natural *Baſhfulneſs*, and for their want of Care, to have their moſt excellent Things repreſented to Strangers with the beſt Advantage. This ſilent and reſerv'd Humour has no doubt been very prejudicial to us, in the Judgment that our Neighbours have often made, not only concerning the Condition,

dition of our *Learning*, but alſo of our *political Affairs*. I will therefore treſpaſs a little on this *Diſpoſition* of my *Countrymen*, and affirm, that as the *Engliſh* Name does manifeſtly get Ground, by the Bravery of their *Arms*, the Glory of their *Naval Strength*, and the ſpreading of their *Commerce*; ſo there has been a remarkable Addition to its Renown, by the Succeſs, which all our *Neighbours* expect from this *Aſſembly*.

It is evident, that this *ſearching Spirit*, and this Affection to *ſenſible Knowledge*, does prevail in moſt Countries round about us. 'Tis true, the Conveniences for ſuch Labours are not equal in all Places. Some want the Aſſiſtance of others *Hands*; ſome the Contribution of others *Purſes*; ſome the Benefit of excellent *Inſtruments*, ſome the *Patronage* of the Civil *Magiſtrates*: But yet according to their ſeveral *Powers*, they are every where intent on ſuch *practical Studies*. And the moſt conſiderable Effects of ſuch Attempts throughout *Europe* have been ſtill recommended to this *Society*, by their *Authors*, to be examined, approved, or corrected.

*In France.* The Country, that lyes next to *England* in its Situation is *France*; and that is alſo the neareſt to it, in its Zeal for the Promotion of *Experiments*. In that Kingdom, the *Royal Society* has maintained a perpetual Intercourſe, with the moſt eminent Men of *Art* of all Conditions; and has obtained from them, all the Help which might juſtly be hoped for, from the *Vigour*, and *Activity*, and *Readineſs* of Mind, which is natural to that People. From their *Phyſicians*, *Chirurgeons*, and *Anatomiſts*, it has receiv'd many faithful *Relations* of extraordinary *Cures*; from their moſt judicious *Travellers* the Fruits of their *Voyages*; from their

most famous *Mathematicians*, diverse *Problems*, which have been solved many different Ways; from their *Chymists* the effects of their *Fires*; and from others of their best *Observers*, many Rarities, and Discourses of their *Fruits*, *Silk*, *Wine*, *Bread*, *Plants*, *Salt*, and such natural Productions of their Soil. And to instance once for all, it has been affectionately invited to a mutual Correspondence by the *French Academy* of *Paris*: In which Invitation, there is one Expression, that ought not to be pass'd over in Silence; that they acknowledge the *English Nation*, to have many Advantages for the propagating of *real Philosophy*, which are wanting to all others. This Confession is true: Yet these Advantages, unless they had been improved by this *Institution*, had been only as those, that we have for Fishing, Objections and Arguments of our Sloth.

*In* Italy. In *Italy* the *Royal Society* has an excellent Privilege of receiving and imparting *Experiments*, by the Help of one of their own *Fellows*, who has the Opportunity of being *Resident* there for them, as well as for the *King*. From thence they have been earnestly invited to a mutual Intelligence, by many of their most noble Wits, but chiefly by the Prince *Leopoldo*, Brother to the Great Duke of *Tuscany*; who is the Patron of all the *inquisitive Philosophers* of *Florence*; from whom there is coming out under his Name an Account of their Proceedings called *Ducal Experiments*. This Application to the *Royal Society* I have mention'd, because it comes from that Country, which is seldom wont to have any great Regard to the *Arts* of these *Nations*, that lye on this side of their Mountains.

*In* Germany. In *Germany*, and its neighbouring Kingdoms, the *Royal*

*Royal Society* has met with great Veneration; as appears by ſeveral Teſtimonies in their late *printed Books*, which have been ſubmitted to its Cenſure; by many Curioſities of *Mechanick Inſtruments*, that have been tranſmitted to it; and by the *Addreſſes* which have been ſent from their *Philoſophical Inquirers*. For which Kinds of Enterprizes the Temper of the *German* Nation is admirably fit, both in reſpect of their peculiar Dexterity in all Sorts of manual *Arts*, and alſo in Regard of the plain and unaffected Sincerity of their *Manners*; wherein they ſo much reſemble the *Engliſh*, that we ſeem to have deriv'd from them the Compoſition of our *Minds*, as well as to have deſcended from their *Race*.

In the *Low-Countries*, their Intereſt, and Reputation has been eſtabliſhed, by the Friendſhip of ſome of their chief learned Men, and principally of *Hugenius*. This Gentleman has beſtowed his Pains, on many Parts of the *ſpeculative* and *practical Mathematicks*, with wonderful Succeſſes. And particularly his applying the Motion of *Pendulums* to Clocks, and Watches, was an excellent *Invention*. For thereby there may be a Means found out of bringing the *Meaſures* of *Time*, to an exact *Regulation*; of which the Benefits are infinite. In the Proſecution of ſuch *Diſcoveries*, he has often required the Aid of this *Society*; he has receiv'd the Light of their *Trials*, and a Confirmation of his own, and has freely admitted their *Alterations* or *Amendments*. And this learned Correſpondence with him, and many others, is ſtill continued, even at this preſent Time, in the Breach between our *Countries*: Their great Founder, and Patron ſtill permitting them to maintain the Traffick of Sciences, when all other *In the Low-Countries.*

other *Commerce* is intercepted. Whence we may gueſs, what may be expected from the peaceful Part of our King's Reign, when his very Wars are managed without Injury to the Arts of *Civil Knowledge*.

*Viſits of Foreigners.* But not to wander any farther in *Particulars*, it may perhaps in *general* be ſafely computed, that there has been as large a Communication of Foreign *Arts*, and *Inventions* to the *Royal Society*, within this ſmall Compaſs of Time, as ever before did paſs over the *Engliſh* Channel, ſince the very firſt Tranſportation of Arts into our *Iſland*. And that this Benefit will ſtill increaſe by the Length of Time is indubitable, from the *Reception*, which has been given to the *Scholars*, *Nobility*, *Embaſſadors*, and Foreign *Princes*, who of late Years have travell'd hither, to behold a *Country*, which had been the Stage of ſo famous a War, and ſo miraculous a Peace. All theſe have ſtill viſited the *Royal Society*, as one of the firſt and *nobleſt Fruits* of our *Reſtoration*. From hence they have return'd Home, with a free Engagement of their Aſſiſtance; the *Men* of Learning aſſuring it of a Contribution of their *Labours*, and the *Stateſmen* and *Princes* of their *Authority* and Endeavours, in ſatisfying all *philoſophical Queries*, with which they have been plentifully furniſhed.

It would be a uſeleſs Pomp to reckon up a *Catalogue* of their *Names*; eſpecially ſeeing they are already recorded with Gratitude, in a more laſting Monument, the *Regiſter* of the *Society*. Only it will not, I think, be amiſs, if I mention the Viſit of one *Prince*, becauſe it may afford us a profitable Obſervation, When the Duke of *Brunſwick* and *Lunenburgh* was introduced into their weekly *Aſſembly*, and had ſubſcribed his Name to their *Statutes*; there was accord-

ing

ding to the Cuſtom, one of the *Fellows* appointed, to interpret to him, what Experiments were produc'd, and examin'd at that Meeting. But his *Highneſs* told them, that it was not neceſſary they ſhould put themſelves to that Trouble; for he well underſtood our Language, having been drawn to the Study of it, out of a deſire of reading our *Philoſophical Books*. From whence there may this Concluſion be made, that if ever our *Native Tongue* ſhall get any Ground in *Europe*, it muſt be by augmenting its *experimental Treaſure*. Nor is it impoſſible, but as the *Feminine* Arts of *Pleaſure* and *Gallantry* have ſpread ſome of our neigbouring Languages to ſuch a vaſt Extent; ſo the *Engliſh Tongue* may alſo in Time be more enlarg'd, by being the Inſtrument of conveying to the World the *Maſculine* Arts of *Knowledge*.

Sect. XXIV. *The Incouragements the R. S. has receiv'd at home.*

I now come to relate, what *Incouragements* this Deſign has receiv'd at home in its native *Soil*. And I will aſſure my *Reader*, that the *Original* of the *Royal Society* has found a general *Approbation* within ourſelves, and that the moſt prudent Men of all Profeſſions and Intereſts, have ſhewn by their Reſpects to theſe hopeful Beginnings, that there is a *Reverence* due to the firſt Trials and Intentions, as well as to the laſt Accompliſhment of generous Attempts.

*From our Citizens.*

Of our chief and moſt wealthy *Merchants* and *Citizens*, very many have aſſiſted it with their Preſence; and thereby have added the induſtrious, punctual, and active *Genius* of Men of *Traffick*,, to the quiet, ſedentary, and reſerv'd Temper of Men of *Learning*. They have contributed their *Labours*; they have help'd their *Correſpondence*; they have employ'd

their *Factors* abroad to answer their *Inquiries*; they have laid out in all Countries for *Observations*; they have bestow'd many considerable Gifts on their *Treasury* and Repository. And chiefly there is one *Bounty* to be here inserted, which for the singular Benefit that may be expected from it, deserves the *Applause* and *Imitation* of this and future Times. It is the *Establishment* made by Sir *John Cutler*, for the reading on *Mechanicks*, in the Place where the *Royal Society* shall meet. This is the first *Lecture* that has been founded of this Kind, amidst all the vast *Munificence* of so many *Benefactors to Learning* in this latter Age. And yet this was the most necessary of all others. For this has chiefly caus'd the slow Progress of *manual Arts*; that the *Trades* themselves have never serv'd *Apprentiships*, as well as the *Tradesmen*; that they have never had any *Masters* set over them, to direct and guide their Works, or to vary and enlarge their Operations.

*From our Physicians.*

Of our *Physicians*, many of the most judicious have contributed their *Purses*, their *Hands*, their *Judgments*, their *Writings*. This they have done, though they have also in *London* a College peculiar to their *Profession*; which ever since its first Foundation, for the Space of a hundred and fifty Years, has given the World a Succession of the most eminent *Physicians* of *Europe*. In *that* they confine themselves to the Advancement of *Physick*: But in *this*, they have also with great Zeal and Ability promoted this *universal Inspection*, into all *natural Knowledge*. For without Danger of *Flattery*, I will declare of the *English Physicians*, that no Part of the World exceeds them, not only in the Skill of their own *Art*, but in *general Learning*; and of very many of that Profession I will affirm, that *all*

*Apollo is their own,* as it was said by the best *Poet* of this Age, of one of the most excellent of their Number.

Of our *Nobility* and *Gentry*, the most noble and *illustrious* have condescended to labour here with their *Hands*, to impart their *Discoveries*, to propose their *Doubts*, to assist and defray the *Charge* of their *Trials*. And this they have done with such a universal Agreement, that it is almost the only thing, wherein the *Nobility* of all the three Kingdoms are *united*. In their *Assemblies* for making Laws they are separated; in their Customs and Manners of Life they differ; in their Humouas too, they are thought not much of kin to each other. But in the *Royal Society* the *Scotch*, the *Irish*, the *English* Gentry do meet, and communicate, without any Distinction of *Countries* or Affections. From hence no doubt very much *political*, as well as *philosophical* Benefit will arise. By this means, there is a good Foundation laid for removing of that Aversion, which the *English* are sometimes observ'd to express to the *Natives* of those Kingdoms; which though perhaps it arises from the Knowledge of their own *Advantages* above the other, yet it is a great Hindrance to the Growth of the *British Power*. For as a Kingdom divided against itself, cannot stand; so three Kingdoms divided from each other, in *Tempers*, *Studies*, and *Inclinations*, can never be great, upon one common Interest. *From our Nobility.*

Of our *Ministers of State at home*, and our *Embassadors abroad*, there have been very few employ'd, who are not *Fellows* of the *Royal Society*: and especially these latter have bestow'd their Pains in *foreign Courts*, to collect *Relations* and Secrets of Nature, as well as *From our Statesman.*

of State: For which Service their Way of Life is most convenient, by the Generality of their Converse, the *Privileges* and *Freedom* of their *Dispatches*, and the usual Resort of the most knowing and inquisitive Men to their Company.

*From our Soldiers,*

Our greatest *Captains* and *Commanders* have inroll'd their *Names* in this Number, and have regarded these *Studies*: which are not, as other Parts of *Learning*, to be call'd the *Studies of the Gown*; for they do as well become the Profession of a *Soldier*, or any other Way of Life. Nor have our most renown'd *Generals* neglected the Opportunities of *philosophical* Inquiries, even in the midst of their greatest *Enterprises*, on which the Fate of *Kingdoms* has depended. They have been furnish'd with Instruments and Directions by the *Royal Society*, and amidst the Tumult of *Wars*, and *Government* of *Fleets*, they have found Leisure to make some *Trials* of *Experiments*: which Works as much excell that of *Declaiming*, which some of the *Roman Generals* us'd in their *Camps*, as it is better to *do*, than to *talk* well.

*From our Churchmen.*

Of our *Churchmen* the greatest and the most *Reverend*, by their Care and Passion, and Endeavours in advancing this *Institution*, have taken off the unjust Scandal from *Natural* Knowledge, that it is an Enemy to *Divinity*. By the perpetual *Patronage* and *Assistance* they have afforded the *Royal Society*, they have confuted the false Opinions of those Men, who believe that *Philosophers* must needs be *irreligious*: they have shewn, that in our *Veneration* of *God's almighty Power*, we ought to imitate the manner of our Respect to *earthly Kings*. For as the greater their *Dominion* is,

the more Obſervance is wont to be given to their neareſt Servants and Officers; ſo the Greatneſs of the *Divine Majeſty* is beſt to be worſhipped, by the due honouring and obſerving of *Nature*, which is his immediate Servant, and the univerſal *Miniſter* of his Pleaſure.

Sect. XXV. *From the Royal Family.*

But I make haſte to that, which ought to be eſteem'd the very *Life* and Soul of this Undertaking, the Protection and Favour of the *King* and the *Royal Family*. When the *Society* firſt addreſs'd themſelves to his Majeſty, he was pleaſed to expreſs much Satisfaction, that this Enterpriſe was begun in *his Reign:* he then repreſented to them the Gravity and Difficulty of their Work, and aſſured them of all the kind Influence of his *Power* and *Prerogative*. Since that he has frequently committed many Things to their Search: he has refer'd many foreign Rarities to their *Inſpection:* he has recommended many domeſtick *Improvements* to their Care: he has demanded the Reſult of their *Trials*, in many Appearances of *Nature:* he has been preſent, and aſſiſted with his own Hands, at the performing of many of their *Experiments*, in his *Gardens*, his *Parks*, and on the *River*. And beſides I will not conceal, that he has ſometimes reprov'd them for the *Slowneſs* of their *Proceedings:* at which Reproofs they have not ſo much Cauſe to be afflicted, that they are the Reprehenſions of a *King*, as to be comforted, that they are the Reprehenſions of his *Love*, and *Affection* to their Progreſs. For a Teſtimony of which *Royal Benignity*, and to free them from all Hindrances and Occaſions of Delay, he has given them the Eſtabliſhment of his *Letters Patents*, of which I will here produce an *Epitome*.

Charles

CHarles *the Second, by the Grace of God, of* England, Scotland, France, *and* Ireland *King, Defender of the Faith,* &c. *To all unto whom these Presents shall come, Greeting. Having long resolved within our self to promote the Welfare of Arts and Sciences, as well as that of our Territories and Dominions, out of our princely Affection to all kind of Learning, and more particular Favour to philosophical Studies: Especially those which endeavour by solid Experiments, either to reform or improve Philosophy. To the intent therefore that these Kinds of Study, which are no where yet sufficiently cultivated, may flourish in our Dominions; and that the learned World may acknowledge us to be, not only the Defender of the Faith, but the Patron and Encourager of all Sorts of useful Knowledge;*

*Know ye, that we out of our special Grace, certain Knowledge, and meer Motion, have given and granted, and do by these Presents give and grant for us, our Heirs, and Successors, That there shall be for ever a Society, consisting of a President, Council, and Fellows, which shall be called by the Name of the President, Council, and Fellows of the Royal Society of* London, *for and improving of natural Knowledge, of which Society we do by these Presents declare our self to be Founder and Patron. And we do hereby make and constitute the said Society by the Name,* &c. *to be a Body corporate, to be continued under the same Name in a perpetual Succession; and that they and their Successors, (whose Studies are to be imployed for the promoting of the Knowledge of natural Things, and useful Arts by Experiments. To the Glory of God, and the good of Mankind,) shall by the aforesaid Name of President, Council,* &c. *be enabled and made capable in Law, to levy, hold, possess, and enjoy, Lands, Tenements,* &c. *Liber-*

*ties,*

*ties, Franchiſes, Juriſdictions, for Perpetuity, or Terms of Lives, or Years, or any other Way: as alſo Goods, Chattels, and all other Things of what Nature or Kind ſoever. And alſo by the Name aforeſaid to give, grant, demiſe, or aſſign the ſaid Lands, Goods, &c. and to do all Things neceſſary thereabout. And the ſaid Perſons by the Name aforeſaid are enabled to implead, be impleaded, ſue, defend, &c. in any Courts, and before any Judges, Officers, &c. whatſoever of the King, his Heirs, and Succeſſors, in all and ſingular Actions real and perſonal: Pleas, Cauſes, &c. of what kind ſoever, as any of his Subjects within his Kingdom of* England, *or Corporations, are by Law capable and enabled to do.*

*And the ſaid Preſident, Council, and Fellows are impower'd to have a Common Seal for their Uſe in their Affairs; and from time to time to break, change, and make anew the ſame, as ſhall ſeem expedient unto them.*

*And his Majeſty, in Teſtimony of his Royal Favour towards the ſaid Preſident, Council, and Fellows, and of his eſpecial Eſteem of them, doth grant a Coat of Arms to them and their Succeſſors,* viz. *On a Field Argent a Canton of the three Lions of* England: *For a Creſt, an Eagle proper on a Ducal Coronet ſupporting a Shield charged with the Lions aforeſaid; and for Supporters, two Talbots with Coronets on their Necks. The ſaid Arms to be born,* &c. *by the ſaid Society upon all Occaſions.*

*And that his Majeſty's Royal Intention may take the better Effect for the good Government of the ſaid Society from time to time: it is eſtabliſh'd, that the Council aforeſaid ſhall conſiſt of twenty one Perſons; (whereof the Preſident for the time being always to be one.) And that all Perſons, which within two Months next enſuing the Date of the ſaid Charter ſhall be choſen by the*

*ſaid*

*ſaid Preſident and Council; and in all times after the ſaid two Months, by the Preſident, Council, and Fellows [and noted in a Regiſter to be kept for that purpoſe] ſhall be Fellows of the ſaid Society, and ſo accounted, and called during Life, except by the Statutes of the ſaid Society to be made, any of them ſhall happen to be amoved. And by how much any Perſons are more excelling in all kinds of Learning, by how much the more ardently they deſire to promote the Honour, Buſineſs, and Emolument of the ſaid Society, by how much the more eminent they are for Integrity, Honeſty, Piety, Loyalty, and good Affection toward his Majeſty, his Crown and Dignity; by ſo much the more fit and worthy ſuch Perſons are to be judged, for Reception into the Society.*

*And for the better Execution of his Royal Grant, his Majeſty hath nominated, &c. his truſty and well-beloved* William, *Viſcount* Brouncker, *Chancellor to his deareſt Conſort Queen* Catherine, *to be the firſt and modern Preſident to continue in the ſaid Office from the Date of the Patent to the Feaſt of St.* Andrew *next enſuing, and until another Perſon of the ſaid Council be duly choſen into the ſaid Office. The ſaid Lord* Brouncker *being ſworn in all things belonging thereto well and faithfully to execute the ſaid Office, before his right well-beloved and right truſty Couſin and Counſellor,* Edward, *Earl of* Clarendon, *Lord High Chancellor of* England, *in the Words following.*

I *William,* Viſcount *Brouncker,* do promiſe to deal faithfully and honeſtly in all things belonging to that Truſt committed to me, as Preſident of the *Royal Society* of *London,* for improving Natural Knowledge. So help me God.

*And*

*And his Majesty hath nominated,* &c. *the Persons following, His trusty and well-beloved Sir* Robert Moray *Knight, one of his Privy Council in his Kingdom of* Scotland, Robert Boyle *Esquire,* William Brereton *Esquire, eldest Son to the Lord* Brereton, *Sir* Kenelme Digby *Knight, Chancellor to his dearest Mother Queen* Mary, *Sir* Gilbert Talbot *Knight, Master of his Jewelhouse, Sir* Paul Neile *Knight, one of the Ushers of his Privy Chamber,* Henry Slingsby *Esquire, one of the Gentlemen of His said Privy Chamber, Sir* William Petty *Knight,* Timothy Clark, *Doctor of Physick, and one of his Physicians,* John Wilkins *Doctor of Divinity,* George Ent *Doctor of Physick,* William Erskyne *Esquire, one of his Cupbearers,* Jonathan Goddard *Doctor of Physick,* William Ball *Esquire,* Matthew Wren *Esquire,* John Evelyn *Esq.* Thomas Henshaw *Esquire,* Dudley Palmer *of* Grays-Inn *Esquire,* Abraham Hill *of* London *Esquire, and* Henry Oldenburg *Esquire, together with the President aforesaid, to be the first and Modern* 21. *of the Council and Fellows of the Royal Society aforesaid, to be continued in the Offices of the Council aforesaid, from the Date of the Patent to the Feast of St.* Andrew *next following, and from thence till other fit Persons be chosen into the said Offices. The said Persons to be sworn before the President of the Society, for the time being, well and truly to execute the said Offices, according to the Form and Effect of the aforesaid Oath to be administred to the President by the Lord Chancellor as aforesaid. For the administring which Oath to the said Persons, and all others hereafter from time to time to be chosen into the said Council, full Power and Authority is granted to the President for the time being: And the said Persons duly sworn, and all other*

*from time to time duly chosen into the said Council and sworn, are to aid, advise and assist in all Affairs, Businesses, and Things concerning the better Regulation, Government and Direction of the Royal Society, and every Member thereof.*

*Furthermore, Liberty is granted to the said Society, lawfully to make and hold Meetings of themselves, for the searching out and Discovery of natural Things, and Transaction of other Businesses relating to the said Society, when and as often as shall be requisite, in any College, Hall, or other convenient Place in* London, *or within ten Miles thereof.*

*And Power is granted to the said Society, from time to time to nominate and chuse yearly, on St.* Andrew's *Day, one of the Council aforesaid, for the time being, to be President of the Society, until St.* Andrew's *Day next ensuing (if he shall so long live, or not be removed for some just and reasonable Cause) and from thence until another be chosen and put into the said Office, the said President so elected, before Admission to that Office, to be sworn before the Council, according to the Form before expressed, who are impower'd to administer the said Oath from time to time, as often as there shall be cause to chuse a President.*

*And in case that the said President, during his Office, shall die, recede, or be removed; then, and so often, it shall be lawful for the Council of the Royal Society, to meet together to chuse one of their Number for President of the said Society, and the Person so chosen and duly sworn, shall have and exercise the Office of President for the remainder of the Year, and until another be duly chosen into the said Office.*

*And in case that any one or more of the Council aforesaid shall die, recede, or be removed (which Persons or*

*any of them, for Misdemeanour, or other reasonable Cause, are declared to be amoveable by the President and the rest of the Council) then and so often it shall be lawful for the President, Council, and Fellows, to chuse one or more of the Fellows of the Royal Society in the room of him or them so deceasing, receding, or remov'd, to compleat the aforesaid Number of twenty one of the Council, which Person or Persons so chosen, are to continue in Office until St.* Andrew's *Day then next ensuing, and until others be duly chosen the said Persons being sworn faithfully to execute their Offices, according to the true Intention of the Patent.*

*And his Majesty doth will and grant unto the said President, Council, and Fellows, full Power and Authority, on St.* Andrew's *Day yearly, to elect, nominate, and change ten of the Fellows of the Royal Society, to supply the Places and Offices of ten of the aforesaid Number of twenty one of the Council, declaring it to be his Royal Will and Pleasure, that ten and no more of the Council aforesaid be annually changed and removed by the President, Council and Fellows aforesaid.*

*And it is granted on the behalf of the said Society, that if it shall happen, that the President be sick, infirm, detain'd in his Majesty's Service, or otherwise occupied, so as he cannot attend the necessary Affairs of the Society, then and so often it shall be lawful for him to appoint one of the Council for his Deputy, who shall supply his Place from time to time, as often as he shall happen to be absent, during the whole time of the said President's Continuance in his Office, unless he shall in the mean time constitute some other of the Council for his Deputy: And the Deputy so constituted is impowered to do all and singular Things which belong to the Office of the President of the Royal Society, and in as ample Manner and Form as the said President*

*may do by virtue of his Majeſty's Letters Patents, be the ſaid Deputy being duly ſworn before the Council in Form before ſpecified, who are impower'd to adminiſter the Oath as often as the Caſe ſhall require.*

*It is farther granted to the Society, to have one Treaſurer, two Secretaries, two or more Curators of Experiments, one or more Clerk or Clerks, and alſo two Serjeants at Mace, who may from time to time attend on the Preſident; all the ſaid Officers to be choſen by the Preſident, Council and Fellows, and to be ſworn in Form and Effect before ſpecified, well and faithfully to execute their Offices, which Oath the Council are impowered to adminiſter: And his Majeſty nominates and appoints his well beloved Subjects, the aforeſaid* William Ball *Eſquire, to be the firſt and modern Treaſurer; and the aforeſaid* John Wilkins *and* Henry Oldenburgh, *to be the firſt and modern Secretaries of the Royal Society, to be continued in the ſaid Offices to the Feaſt of St.* Andrew *next following the Date of the Patent. And that from time to time and ever hereafter, on the ſaid Feaſt of St.* Andrew *(if it be not Lord's Day, and if it be Lord's Day, on the next Day after) the Preſident, Council, and Fellows aforeſaid, are impower'd to nominate and chuſe honeſt and diſcreet Men for Treaſurer and Secretaries, which are to be of the Number of the Council of the Royal Society, which Perſons elected and ſworn, in Form before ſpecified, are to exerciſe and enjoy the ſaid Offices until the Feaſt of St.* Andrew *next then following.*

*And if it ſhall happen, that the aforeſaid Election of the Preſident, Council, Treaſurer, and Secretaries, or any of them, cannot be made or perfected on the Feaſt of St.* Andrew *aforeſaid; it is granted to the aforeſaid Preſident, Council, and Fellows, that they may lawfully no-*

*nominate and aſſign another Day, as near to the ſaid Feaſt of St.* Andrew *as conveniently may be, for making or perfecting the ſaid Elections, and ſo from Day to Day till the ſaid Elections be perfected.*

*And in caſe that any of the aforeſaid Officers of the Royal Society ſhall die, recede, or be remov'd from their reſpective Offices, then and ſo often it ſhall be lawful for the ſaid Preſident, Council and Fellows, to chooſe one or more into the Office or Offices vacant, to hold the ſame during the Reſidue of that Year, and until others be duly choſen and ſworn in their Places.*

*Moreover, on the behalf of the Society, it is granted unto the Preſident and Council, that they may aſſemble and meet together in any College, Hall, or other convenient place in* London, *or within ten Miles thereof (due and lawful Summons of all the Members of the Council to extraordinary Meetings being always premiſed) and that they being ſo met together, have full Power and Authority from time to time, to make, conſtitute, and eſtabliſh ſuch Laws, Statutes, Orders, and Conſtitutions, which ſhall appear to them to be good, uſeful, honeſt, and neceſſary, according to their Judgments and Diſcretions, for the Government, Regulation and Direction of the Royal Society, and every Member thereof: And to do all Things concerning the Government, Eſtate, Goods, Lands, Revenues, as alſo the Buſineſſes and Affairs of the ſaid Society: All which Laws, Statutes, Orders, &c. ſo made, His Majeſty wills and commands, that they be from time to time inviolably obſerved, according to the Tenor and Effect of them: Provided that they be reaſonable, and not repugnant or contrary to the Laws, Cuſtoms, &c. of his Kingdom of* England.

*And furthermore, full Power and Authority is given and*

*and granted unto the ſaid Society, from time to time to chooſe one or more Printers and Gravers, and by writing ſealed with the common Seal of the Society, and ſigned by the Preſident for the time being, to grant them Power to print ſuch Things, Matters and Buſineſſes concerning the ſaid Society, as ſhall be committed to them by the Council from time to time: The ſaid Printers and Gravers, being ſworn before the Preſident and Council in Form before ſpecified, which Preſident and Council are impowered to give the ſaid Oath.*

*And for the greater Advantage and Succeſs of the Society in their philoſophical Studies and Endeavours, full Power and Authority is granted unto them, to require, take, and receive from time to time, dead Bodies of Perſons executed, and the ſame to anatomiſe, to all Intents and Purpoſes, and in as ample Manner and Form as the College of Phyſicians, and Company of Chirurgeons of* London *(by what Names ſoever the ſaid two Corporations are or may be called) have had and made uſe of, or may have and uſe the ſaid Bodies.*

*And for the Improvement of ſuch Experiments, Arts, and Sciences, as the Society may be imployed in, full Power and Authority is granted unto them from time to time by Letters under the Hand of the Preſident, in the Preſence of the Council, to hold Correſpondence and Intelligence with any Strangers, whether private Perſons, or Collegiate Societies, or Corporations, without any Interruption or Moleſtation whatſoever: Provided that this Indulgence or Grant be extended to no farther Uſe than the particular Benefit and Intereſt of the Society, in Matters Philoſophical, Mathematical, and Mechanical.*

*Full Power and Authority is alſo granted on the behalf of the Society to the Council, to erect and build one or more Colleges within* London, *or ten Miles thereof,*

*thereof, of what Form or Quality ſoever, for Habitation, Aſſembling, or Meeting of the Preſident, Council and Fellows, about any Affairs and Buſineſſes of the Society.*

*And if any Abuſes or Differences ſhall ever hereafter ariſe and happen about the Government or Affairs of the Society, whence the Conſtitution, Progreſs, and Improvement, or Buſineſſes thereof may ſuffer or be hindred: In ſuch Caſes his Majeſty aſſigns and authoriſes his right truſty and right well beloved Couſin and Counſellor,* Edward *Earl of* Clarendon *Lord High Chancellor of* England, *by himſelf during his Life, and after his Deceaſe the Lord Archbiſhop of* Canterbury, *the Lord Chancellor, or Lord Keeper of the Great Seal of* England, *the Lord High Treaſurer of* England, *the Lord Keeper of the Privy Seal, the Lord Biſhop of* London, *and the two principal Secretaries of State for the Time being, or any four or more of them, to compoſe and redreſs any ſuch Differences or Abuſes.*

*And laſtly, his Majeſty ſtrictly charges and commands all Juſtices, Mayors, Aldermen, Sheriffs, Bailiffs, Conſtables, and all other Officers, Miniſters, and Subjects whatſoever, from time to time to be aiding and aſſiſting unto the ſaid Preſident, Council, and Fellows of the Royal Society, in and about all Things, according to the true Intention of his Letters Patent.*

This is the *Legal Ratification* which the *Royal Society* has received. And in this Place I am to render their publick Thanks to the Right Honourable the Earl of *Clarendon* Lord Chancellor of *England*, to Sir *Jeffery Palmer* Attorney General, and to Sir *Heneage Finch* Sollicitor General; who by their chearful Concurrence, and free Promotion of this Confirmation, have wiped away the Aſperſion, that has been ſcandalouſly

ſcandalouſly caſt on the *Profeſſion* of the *Law*, that it is an Enemy to *Learning* and the *civil Arts*. To ſhew the Falſhood of this Reproach, I might inſtance in many *Judges* and *Counſellors* of all Ages, who have been the Ornaments of the *Sciences*, as well as of the *Bar*, and *Courts* of *Juſtice*. But it is enough to declare, that my Lord *Bacon* was a *Lawyer*, and that theſe eminent *Officers* of the *Law*, have completed this Foundation of the *Royal Society*; which was a Work well becoming the Largeneſs of his Wit to deviſe, and the Greatneſs of their Prudence to eſtabliſh.

Sect. XXIV. *Their Councils and Statutes.*

According to the Intention of theſe *Letters Patents*, their *Council* has ever ſince been annually renewed; their *Preſident*, their *Treaſurer*, their *Secretaries* choſen: The chief Employments of the *Council* have been to manage their political Affairs, to regulate Diſorders, to make Addreſſes, and Applications in their Behalf: to regard their *Privileges*, to diſperſe *Correſpondents*, but principally to form the Body of their *Statutes*, which I will here inſert.

### *An Abſtract of the Statutes of the* Royal Society.

*WHatever Statute ſhall be made, or repealed, the making or repealing of it ſhall be voted twice, and at two ſeveral Meetings of the Council.*

*This Obligation ſhall be ſubſcribed by every Fellow; or his Election ſhall be void.*

WE who have hereto ſubſcrib'd, do promiſe each for himſelf, that we will endeavour to promote the good of the Royal Society of *London*, for the Improvement of natural Knowledge, and to purſue the Ends, for which the ſame was founded; that we were

will be present at the Meetings of the Society, as often as conveniently we can; especially at the anniversary Elections, and upon extraordinary Occasions; and that we will observe the Statutes and Orders of the said Society: Provided, that whenever any of us shall signify to the President under his Hand, that he desires to withdraw from the Society, he shall be free from this Obligation for the future.

*Every Fellow shall pay his Admission-Money, and afterwards Contribution, towards the defraying of the Charges of Observations and Experiments,* &c.

*The ordinary Meetings of the Royal Society shall be held once a Week, where none shall be present, besides the Fellows, without the leave of the Society, under the Degree of a Baron in one of his Majesty's three Kingdoms, or of his Majesty's Privy Council; or unless he be an eminent Foreigner, and these only without the leave of the President.*

*The Business of their weekly Meetings shall be, To order, take account, consider, and discourse of, philosophical Experiments and Observations; to read, hear, and discourse upon, Letters, Reports, and other Papers, containing philosophical Matters; as also to view, and discourse upon the Productions and Rarities of Nature, and Art; and to consider what to reduce from them, or how they may be improved for Use or Discovery.*

*The Experiments that be made at the Charge of the Society; two Curators at least shall be appointed for the Inspection of those which cannot be performed before the Society; by them the bare Report of Matter of Fact shall be stated and returned.*

*The Election of Fellows shall be made by way of Ballot; and their Admission by a solemn Declaration made by the President of their Election.*

*The Election of the Council and Officers shall be made once a Year: Eleven of the present Council shall be continued by Lot, for the next Year, and ten new ones chosen in like Manner. Out of this new Council shall be elected a President, Treasurer, and two Secretaries in the same Way.*

*The President shall preside in all Meetings, regulate all Debates of the Society and Council; State, and put Questions; call for Reports and Accounts from Committees, Curators, and others; summon all extraordinary Meetings upon urgent Occasions, and see to the Execution of the Statutes. The Vice-President shall have the same Power in the Absence of the President.*

*The Treasurer, or his Deputy, shall receive and keep Accounts of all Money due to the Society, and disburse all Money payable by the Society. He shall pay small Sums by Order of the President under his Hand, but those that exceed five Pounds by Order of the Council. All Bills of Charges for Experiments shall first be signed by the Curators. The Accounts of the Treasurer shall be audited four times a Year, by a Committee of the Council, and once a Year by a Committee of the Society.*

*The Secretaries are to take Notes of the Orders, and material Passages of the Meetings; to take care of the Books, Papers, and Writings of the Society; to order, and direct the Clerks in making Entries of all Matters in the Register and Journal Books of the Society or Council; to draw up such Letters as shall be written in their Name, which shall be approved at one of their Meetings; to give notice of the Candidates propounded in order to Election.*

*The Curators by Office shall have a sufficient Allowance for their Encouragement, which shall increase proportionably with the Revenue of the Society,* pro-

vided that it exceed not two hundred Pounds a Year. *They ſhall be well skilled in philoſophical and mathematical Learning, well vers'd in Obſervations, Inquiries, and Experiments of Nature and Art. They ſhall take care of the managing of all Experiments and Obſervations appointed by the Society or Council, and report the ſame, and perform ſuch other Tasks, as the Society or Council ſhall appoint; ſuch as the examining of Sciences, Arts, and Inventions now in uſe, and the bringing in Hiſtories of natural and artificial Things,* &c. *They ſhall be propounded at leaſt a Month before they are choſen. They ſhall be examined by the Council before the Election: To their Election every Member of the Society ſhall be ſummoned: They ſhall at firſt be only elected for a Year of Probation, except they be of known Merits; at the end of the Year, they ſhall be either elected for Perpetuity, or for a longer Time of Probation, or wholly rejected. The Cauſes of ejecting a Curator ſhall be the ſame with ejecting a Fellow, or for fraudulent Dealing and Negligence in the Affairs of the Society, provided that he ſhall firſt receive three reſpective Admonitions. If any Curator ſhall be diſabled by Age, Infirmity, or any Caſualty, in the Service of the Society, ſome Proviſion ſhall be made for him during Life, if his Condition requires, according as the Council ſhall think fit.*

*The Clerk ſhall conſtantly attend at all Meetings; he ſhall follow the Directions of the Secretaries, in regiſtring and entring all Matters that ſhall be appointed: he ſhall not communicate any thing contained in their Books, to any that is not a Fellow.* He ſhall have a certain Rate for what he copies, and a yearly Stipend for his Attendance.

*The Printer ſhall take care for the printing of ſuch*

*Books as ſhall be committed to him by Order of the Society, or Council; and therein he ſhall obſerve their Directions, as to the Correction of the Edition, the Number of Copies, the Form, or Volume,* &c.

*The Operators of the Society, when they have any of their Work under their Hands, ſhall not undertake the Work of any other Perſons, which may hinder the Buſineſs of the Society.* They ſhall have Salaries for their Attendance.

*The common Seal of the Society ſhall be kept in a Cheſt with three Locks, and three different Keys, by the Preſident, Treaſurer, and one of the Secretaries. The Deeds of the Society ſhall be paſs'd in Council, and ſeal'd by them and the Preſident.*

*The Books that concern the Affairs of the Society, ſhall be the Charter Book, Statute Book, Journal Books, Letter Books, and Regiſter Books, for the entring of philoſophical Obſervations, Hiſtories, Diſcourſes, Experiments, Inventions.*

*The Names of Benefactors ſhall be honourably mentioned in a Book provided for that purpoſe.*

*In caſe of Death, or Receſs of any Fellow, the Secretaries are to note it in the Margin of the Regiſter, over againſt their Names.*

*The Cauſes of Ejection ſhall be contemptuous Diſobedience to the Statutes and Orders of the Society; defaming or malicious damnifying the ſame. This ſhall be declared by the Preſident at one of the Meetings; and the Ejection recorded.*

When theſe Statutes were preſented to his *Majeſty*, he was pleas'd to ſuperſcribe himſelf their *Founder* and *Patron*; his *Royal Highneſs*, and his *Highneſs Prince Rupert*, at the ſame time, declaring themſelves *Fellows*.

Nor

Sect. XXVII. *The King's Example in promoting Experiments.*

Nor has the *King* only incourag'd them, by Kindneſs and *Words*, and by *Acts* of *State*; but he has alſo provok'd them to unwearied Activity in their *Experiments*, by the moſt effectual Means of his *Royal Example*. There is ſcarce any one ſort of *Work*, whoſe Advancement they regard; but from his *Majeſty's* own Labours they have receiv'd a *Pattern* for their Indeavours about it. They deſign the multiplying and beautifying of *Mechanick Arts*: And the Noiſe of *Mechanick Inſtruments* is heard in *Whitehall* itſelf. They intend the Perfection of *Graving*, *Statuary*, *Limning*, *Coining*, and all the Works of Smiths, in Iron, or Steel, or Silver: And the moſt excellent *Artiſts* of theſe kinds have Proviſion made for their Practice, even in the Chambers and Galleries of his *Court*. They purpoſe the Trial of all manner of *Operations by Fire*; And the *King* has under his own Roof found place for *Chymical Operators*. They reſolve to reſtore, to enlarge, to examine *Phyſick*; and the *King* has indow'd the College of *London* with new Privileges, and has planted a Phyſick Garden under his own Eye. They have beſtow'd much Conſideration on the *propagating of Fruits and Trees*: And the *King* has made *Plantations* enough, even almoſt to repair the Ruins of a Civil War. They have begun an exact *Survey* of the *Heavens*; and St. *James's Park* may witneſs, that *Ptolomy* and *Alphonſo* were not the only *Monarchs*, who obſerv'd the Motions and Appearances of the *Stars*. They have ſtudied the promoting of *Architecture* in our Iſland; and the Beauty of our late *Buildings*, and the Reformation of his own Houſes, do ſufficiently manifeſt his Skill and Inclination to that *Art*: of which Magnificence, we had ſeen more Effects

fects e'er this, if they had not been call'd off by this War, from Houſes of *Convenience*, to thoſe of *Strength*. They have principally conſulted the Advancement of *Navigation*; and the *King* has been moſt ready to reward thoſe, that ſhall diſcover the *Meridian*. They have employ'd much Time in examining *the Fabrick of Ships*, the Forms of their *Sails*, the Shapes of their *Keels*, the Sorts of Timber, the planting of Fir, the bettering of Pitch, and Tar, and Tackling. And in all *maritime* Affairs of this Nature, his *Majeſty* is acknowledg'd to be the beſt *Judge* amongſt Seamen and Shipwrights, as well as the moſt powerful amongſt *Princes*.

Sect. XXVIII. *And the preſent Genius of our Nation.*

By theſe and many other Inſtances it appears, that the *King* has not only given Succour to the *Royal Society*, in the proſecution of their *Labours*; but has alſo led them on their *Way*, and trac'd out to them the Paths, in which they ought to tread. And with this propitious Inclination of his *Majeſty*, and the higheſt *Degrees* of Men, the *Genius* of the *Nation* itſelf irreſiſtibly conſpires. If we reflect on all the paſt Times of *Learning* in our *Iſland*; we may ſtill obſerve ſome remarkable *Accidents*, that retarded theſe *Studies*, which were ſtill ready to break forth, in ſpight of all Oppoſition.

Till the Union of the two Houſes of *York* and *Lancaſter*, the whole Force of our *Country* was ingag'd in Domeſtick Wars, between the *King* and the *Nobility*, or in the furious Contentions between the divided Families: unleſs ſometimes ſome magnanimous *Prince* was able to turn their Strength to foreign Conqueſts. In King *Henry the Seventh* the two *Roſes* were join'd: His Government was like his own Temper,

Temper, *close, severe, jealous, avaritious*, and withal *victorious*, and *prudent:* but how unprepar'd his Time was for new Discoveries, is evident by the slender Account that he made of the Proposition of *Columbus*. The Reign of King *Henry the Eighth* was *vigorous, haughty, magnificent, expensive, learned:* But then the Alteration of *Religion* began, and that alone was then sufficient to possess the Minds of Men.

The *Government* of King *Edward the Sixth* was contentious, by reason of the Factions of those who manag'd his Childhood; and the Shortness of his Life depriv'd us of the Fruits, that might have been expected from the prodigious Beginnings of the *King* himself. That of *Queen Mary* was *weak, melancholy, bloody* against the Protestants, obscur'd by a foreign Marriage, and unfortunate by the Loss of *Calais*. That of *Queen Elizabeth* was *long, triumphant, peaceable* at home, and *glorious* abroad. Then it was shewn, to what height the *English* may rise, when they are commanded by a *Prince*, who knows how to govern their Hearts as well as Hands. In her Days the *Reformation* was settled, Commerce was establish'd, and *Navigation* advanc'd. But though Knowledge began abundantly to spring forth, yet it was not then seasonable for *Experiments* to receive a *publick Incouragement:* while the Writings of Antiquity, and the Controversies between us and the Church of *Rome*, were not fully study'd and dispatch'd.

The *Reign* of *King James* was happy in all the Benefits of *Peace*, and plentfully furnish'd with Men of profound *Learning:* But in Imitation of the *King*, they chiefly regarded the Matters of *Religion* and *Disputation*; so that even my Lord *Bacon*, with all his Authority in the State, could never raise any *College*

*of*

*of Salomon*, but in a *Romance*. That of *King Charles the first* began indeed to be ripe for such Undertakings, by reason of the Plenty and Felicity of the first Years of his *Government*, and the Abilities of the *King* himself; who was not only an inimitable *Master*, in *Reason* and *Eloquence*, but excell'd in very many practical *Arts*, beyond the usual Custom of *Kings*, nay even beyond the Skill of the best *Artists* themselves. But he, alas! was call'd away from the Studies of *Quiet* and *Peace*, to a more dangerous and a more honourable Reputation. The chief Triumphs that Heav'n reserv'd for him, were to be gather'd from his *suffering Virtues*: In them he was only exceeded by the Divine Example of our *Saviour*; in Imitation of whose Passion, those Afflictions, and those Thorns which the rude Soldiers design'd for his *Disgrace* and *Torment*, became his *Glory* and his *Crown*.

The late Times of *Civil War* and *Confusion*, to make Recompence for their infinite Calamities, brought this Advantage with them, that they stir'd up Men's Minds from *long Ease*, and a *lazy Rest*, and made them *active*, *industrious* and *inquisitive*: it being the usual Benefit that follows upon *Tempests* and *Thunders* in the *State*, as well as in the *Sky*, that they purifie and clear the *Air*, which they disturb. But now since the *King's* Return, the Blindness of the former *Ages*, and the Miseries of this last, are vanish'd away: now Men are generally weary of the *Relicks* of *Antiquity*, and satiated with *Religious Disputes*: now not only the *Eyes* of Men, but their *Hands* are open and prepar'd to *labour*: Now there is an universal *Desire* and *Appetite* after *Knowledge*, after the peaceable, the fruitful, the nourishing *Knowledge*, and not after that of antient Sects, which only yielded hard indigestible *Arguments*,

or ſharp *Contentions* inſtead of *Food*; which when the Minds of Men requir'd *Bread*, gave them only a *Stone*, and for a *Fiſh* a *Serpent*.

Sect. XXIX. *The Subjects about which they have been employ'd.*

Whatever they have hitherto attempted, on theſe Principles and Incouragements, it has been carry'd on with a vigorous Spirit, and wonderful good Fortune, from their firſt Conſtitution down to this Day. Yet I overhear the Whiſpers and Doubts of many, who demand, what they have done all this while? And what they have produc'd, that is anſwerable to theſe mighty Hopes, which we indeavour to make the World conceive of their Undertaking?

If thoſe who require this Account, have themſelves perform'd any worthy Things, in this Space of Time; it is fit, that we ſhould give them Satisfaction. But they who have done nothing at all, have no reaſon to upbraid the *Royal Society*, for not having done as much as they fancy it might. To thoſe therefore who excite it to work by their Examples, as well as Words and Reproofs, methinks it were a ſufficient Anſwer, if I ſhould only repeat the particulars I have already mention'd, wherein the *King* has ſet on foot a *Reformation*, in the Ornaments, and Advantages of our Country. For though the original Praiſe of all this is to be aſcrib'd to the Genius of the *King* himſelf; yet it is but juſt, that ſome Honour ſhould thence deſcend to this Aſſembly, whoſe Purpoſes are conformable to his Majeſty's Performance of that Nature: Seeing all the little Scandals, that captious Humours have taken againſt the *Royal Society*, have not riſen from their general Proceedings, but from a few pretended Offences of ſome of their private Members; it is but reaſon, that we ſhould alledge in their

Commendation, all the excellent Deſigns, which are begun by the *King*, who has not only ſtyl'd himſelf their *Founder*, but acted as a particular *Member* of their Company.

To this I will alſo add, that in this Time, they have paſs'd through the firſt Difficulties of their *Charter* and Model; and have overcome all Oppoſitions, which are wont to ariſe, againſt the Beginnings of great Things. This certainly alone were enough to free them from all Imputation of Idleneſs, that they have fram'd ſuch an Aſſembly in ſix Years, which was never yet brought about in ſix thouſand. Beſides this the World is to conſider, that if any ſhall think, the whole Compaſs of their Work might have come to a ſudden Iſſue; they ſeem neither to underſtand the Intentions of the *Royal Society*, nor the Extent of their Task. It was never their Aim, to make a violent Diſpatch. They know, that Precipitancy in ſuch Matters was the Fault of the Antients: And they have no Mind, to fall into the ſame Error, which they indeavour to correct. They began at firſt on ſo large a Bottom, that it is impoſſible, the whole Frame ſhould be ſuddenly compleated. 'Tis true, they that have nothing elſe to do, but to expreſs, and adorn Concluſions of Knowledge already made, may bring their Arts to an End, as ſoon as they pleaſe: But they who follow the ſlow and intricate Method of Nature, cannot have the Seaſons of their Productions, ſo much in their own Power. If we would always exact from them daily or weekly Harveſts; we ſhould wholly cut off the Occaſions of very many excellent Inventions, whoſe Subjects are remote, and come but ſeldom under their Conſideration. If we would require them, immediately to reduce all their Labours, to publick and conſpicu-

ous

ous Uſe; by this dangerous Speed, we ſhould draw them off from many of the beſt Foundations of Knowledge. Many of their nobleſt Diſcoveries, and ſuch as will hereafter prove moſt ſerviceable, cannot inſtantly be made to turn to Profit. Many of their weightieſt and moſt precious *Obſervations*, are not always fit to be expoſed to open View: For it is with the greateſt Philoſophers, as with the richeſt Merchants, whoſe Wares of greateſt Bulk and Price, lye commonly out of Sight, in their Warehouſes, and not in their Shops.

This being premis'd, I will however venture to lay down a brief Draught of their moſt remarkable Particulars; which may be reduced to theſe following Heads: The Queries and Directions they have given abroad; the Propoſals and Recommendations they have made; the Relations they have received; the Experiments they have tried; the Obſervations they have taken; the Inſtruments they have invented; the Theories that have been propoſed; the Diſcourſes they have written, or publiſhed; the Repoſitory and Library; and the Hiſtories of Nature, and Arts, and Works they have collected.

Their Manner of gathering, and diſperſing *Queries*, is this. Firſt, they require ſome of their particular Fellows, to examine all Treatiſes and Deſcriptions of the Natural and Artificial Productions of thoſe Countries, in which they would be informed. At the ſame Time, they employ others to diſcourſe with the Seamen, Travellers, Tradeſmen, and Merchants, who are likely to give them the beſt Light. Out of this united Intelligence from Men and Books, they compoſe a Body of Queſtions, concerning all

the obſervable Things of thoſe Places. Theſe Papers being produced in their weekly Aſſemblies, are augmented, or contracted, as they ſee Occaſion. And then the Fellows themſelves are wont to undertake their Diſtribution into all Quarters, according as they have the Convenience of Correſpondence: Of this Kind I will here reckon up ſome of the principal, whoſe particular Heads are free to all that ſhall deſire Copies of them for their Direction.

They have compoſed Queries, and Directions, what Things are needful to be obſerved, in order to the making of a natural Hiſtory in general; what are to be taken Notice of towards a perfect Hiſtory of the Air, and Atmoſphere, and Weather; what is to be obſerved in the Production, Growth, Advancing or Transforming of Vegetables; what Particulars are requiſite, for collecting a compleat Hiſtory of the Agriculture, which is uſed in ſeveral Parts of this Nation.

They have preſcribed exact Inquiries, and given punctual Advice for the Trial of Experiments of Rarefaction, Refraction, and Condenſation; concerning the Cauſe and Manner of the Petrifaction of Wood; of the Loadſtone; of the Parts of Anatomy, that are yet imperfect; of Injections into the Blood of Animals; and transfuſing the Blood of one Animal into another; of Currents; of the ebbing and flowing of the Sea; of the Kinds, and Manner of the feeding of Oyſters; of the Wonders, and Curioſities obſervable in deep Mines.

They have collected, and ſent abroad Inquiries for the *Eaſt-Indies*, for *China*, for *St. Helena*, for *Teneriff*, or any high Mountain, for *Guinea*, for *Barbary*,

*b* *ary*, and *Morocco*, for *Spain*, and *Portugal*, for *Turky*, for *France*, for *Italy*, for *Germany*, for *Hungary*, for *Transylvania*, for *Poland*, and *Sweden*, for *Iceland*, and *Greenland*, they have given Directions for Seamen in general, and for observing the Eclipses of the Moon; for observing the Eclipses of the Sun by *Mercury*, in several Parts of the World, and for observing the *Satellites* of *Jupiter*.

Of this their Way of Inquiry, and giving Rules for Direction, I will here produce a few Instances; from whose Exactness it may be guessed, how all the rest are performed.

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ANSWERS

# ANSWERS

RETURN'D BY

## Sir *PHILBERTO VERNATTI*

Resident in *Batavia* in *Java Major*,

To certain Inquiries sent thither by Order of the *Royal Society*, and recommended by

## Sir *ROBERT MORAY*.

Q. 1. *Whether Diamonds and other precious Stones grow again, after three or four Years, in the same Places where they have been digged out?*

*A.* Never, or at least as the Memory of Man can attain to.

Q. 2. *Whether the Quarries of Stone in* India, *near* Fetipoca, *not far from* Agra, *may be cleft like Logs, and sawn like Planks, to ceil Chambers, and cover Houses.*

*A.* What they are about the Place mentioned, I have not as yet been well inform'd; but in *Persia* not far from *Cyrus* where the best Wine groweth, there is a sort of hard Stone which may be cleft like Fir-wood, as if it had a Grain in it; the same is at the Coast *Cormandel* about *Sadraspatuam*; where they make but a mark in the Stone, set a Wedge upon it, with a wooden Hammer, as thick and thin as they please; it is used commonly for Pavement in Houses, one Foot square, and so cheap, that such a Stone finely polish'd costs not above six Pence.

Q. 3. *Whether there be a Hill in* Sumatra, *which burneth continually, and a Fountain which runneth pure Balſam?*

*A.* There is a Hill that burneth in *Sumatra* near *Endrapeor*; but I cannot hear of any ſuch Fountain; and I believe that the like Hill is upon *Java Major* oppoſite to *Batavia*; for in a clear Morning or Evening, from the Road a Man may perfectly perceive a continual Smoak riſe from the top, and vaniſh by little and little. I have often felt Earthquakes here, but they do not continue long. In the Year 1656, or 57, (I do not remember well the Time) *Batavia* was cover'd in one Afternoon, about two of the Clock, with a black Duſt, which being gather'd together, was ſo ponderous, that it exceeded the Weight in Gold. I, at that Time, being very ill, did not take much Notice of it, but ſome have gathered it, and if I light upon it, I ſhall ſend you ſome. It is here thought, it came out of the Hill: I never heard of any that had been upon this Hill's top. *Endrapeor* is counted a mighty unwholeſome Place, as likewiſe all others where Pepper grows; as *Jamby*, *Banjar*, *Balingtoan*, *&c.* though ſome impute it to the Hill's burning.

As for the Fountain, it is unknown to us, except *Oleum Terræ* is meant by it, which is to be had in *Sumatra*, but the beſt comes from *Pegu*.

Q. 4. *What River is that in* Java Major *that turns Wood into Stone?*

*A.* There is none ſuch to our Knowledge; yet I have ſeen a Piece of Wood with a Stone at the End of it; which was told me, that was turned into Stone by a River in *Pegu*; but I took it but for a Foppery; for divers *Arbuſta* grow in Rocks, which being appropriated

priated curiously, may easily deceive a too hasty Believer.

Q. 5. *Whether it be true, that upon the Coast of* Achin *in* Sumatra, *the Sea, though it be calm, groweth very high when no Rain falls, but is smooth in Rain, though it blows hard?*

*A.* Sometimes, but not always; the Reason is this, that *Achin* lyeth at the very End and Corner of *Sumatra*, as may be seen by the Map, open in the main Ocean, so that the Sea comes rowling from the *Cabo de bona Esperanza*, and all that way unto it, and it is natural to the Sea to have a continual Motion, let it be ever so calm; which Motion cannot be called a Wave, neither have I any *English* for it at present, but in *Dutch* we call it, *Deyninge van Dee Zee*, and the calmer it is, the higher; the natural Motion of the Sea elevates very slowly the Water; so that I have seen Ships and Junks tossed by these *Deynings* in a calm, (when there is scarce Wind enough to drive a Bubble) that a Man can scarce stand in them; some say this Motion proceeds from boisterous Winds at Sea far distant. That Rain beats down the swelling of these *Deynings* (especially if it be vehement) proceeds naturally from its Weight and Impetuosity. And it is observed, that about *Achin* the Mountains are high and steep, from whose Tops boisterous Winds, called *Travant*, come suddenly (like a Granado-cast) falling into the Sea, are accompanied commonly with a great Shower of Rain, and last not above a Quarter, or at the most, half an Hour, which is too short a Time to disturb the Sea, or to cause a contrary Motion in it, being shelter'd by these Mountains.

Q. 6. *Whether in the Island of* Sambrero, *which lyeth Northwards of* Sumatra, *about eight Degrees Northern*

*thern Latitude, there be found such a Vegetable as Mr.* James Lancaster *relates to have seen, which grows up to a Tree, shrinks down, when one offers to pluck it up, into the Ground, and would quite shrink, unless held very hard? And whether the same, being forcibly pluck'd up, hath a Worm for its Root, diminishing more and more, according as the Tree groweth in Greatness; and as soon as the Worm is wholly turned into the Tree, rooting in the Ground, and so growing great? And whether the same plucked up young turns, by that time it is dry, into a hard Stone, much like to white Corral?*

*A.* I cannot meet with any that ever have heard of such a Vegetable.

Q. 7. *Whether those Creatures that are in these Parts plump, and in Season at the full Moon, are lean and out of Season at the new, and the contrary, at the* East-Indies?

*A.* I find it so here, by Experience at *Batavia*, in Oysters and Crabs.

Q. 8. *What ground there might be for that Relation, concerning Horns taking Root, and growing about* Goa?

*A.* Inquiring about this, a Friend laught, and told me it was a Jeer put upon the *Portuguese*; because the Women of *Goa* are counted much given to Lechery.

Q. 9. *Whether the* Indians *can so prepare that stupifying Herb* Datura, *that they make it lye several Days, Months, Years, according as they will have it, in a Man's Body, without doing him any hurt, and at the end kill him, without missing half an Hour's time?*

*A.* The *China* Men in this Place have formerly used *Datura* as a Fermentation, to a sort of Drink much beloved by the Soldiers and Mariners, called *Suyker-*

*bier*, which makes them raging mad, ſo that it is forbidden ſtrictly under the Penalty of a great Pain to make uſe of the ſame.

Q. 10. *Whether thoſe that be ſtupified by the Juice of this Herb* Datura, *are recovered by moiſtning the Soles of their Feet in fair Water?*

*A.* No. For I have ſeen diverſe Soldiers and Mariners fall into the Rivers and Ditches, being ſtupified by their Drink aforeſaid, who were rather worſe after they were taken out, than better.

Q. 11. *Whether a* Betel *hath ſuch a Contrariety to the* Durion, *that a few Leaves thereof put to a whole Shopful of* Durions, *will make them all rot ſuddenly? And whether thoſe who have ſurfeited on* Durions, *and thereby overheated themſelves, do by laying one Leaf of* Betel *cold upon the Heart, immediately cure the Inflammations and recover the Stomach? This* Betel *being thought to preſerve thoſe* Indians *from Tooth-ach, looſe Gums and Scurvy, and from ſtinking Breath; ſome of it is deſired to be ſent over with the Fruit* Areica, *and the other Ingredients, and Manner of preparing it.*

*A.* I have ſeen that *Betel* Leaves in a ſhort time will ſpoil a *Durion*, take away its Nature, and turn a fat creamy Subſtance into Water. Commonly thoſe that eat great Quantities of *Durions*, eat a *Betel* afterwards as a *Correctorium*; but of laying a Leaf upon the Heart, I have never heard. As for the other Qualities of the *Betel*, I believe they are good, if not abuſed; as moſt of the *Indians* do, who never are without it in their Mouths, no not ſleeping, which corrodes their Teeth, and makes them as black as Jet: It draws from the Head the phlegmatick Humours, which are voided by ſpitting; ſo we uſe it; but

but the *Indians* ſwallow down their Spittle, together with the Juice of the *Betel*, and the *Areica*. The Manner of preparing it is eaſy, being nothing but the *Nut*, *Leaf* and *Calx viva*, of which laſt each one adds as much as pleaſeth his Palate. There is a Sort of Fruit called *Sivgboa*, which is uſed with the *Areica*, inſtead of *Betel*, and can be dried and tranſported as well as the *Areica*, and hath the ſame Force, but a great deal more pleaſant to the Palate.

Q. 12. *Whether the* Papayas, *that beareth Fruit like a Melon, do not grow, much leſs bear Fruit, unleſs Male and Female be together?*

*A.* They grow, as I have ſeen two in the *Engliſh* Houſe at *Bantam*, and bear little Fruit, which never comes to Perfection; but if the Male and Female be together, the one bears great Fruit, the other nothing but Flowers.

Q. 13. *Whether the* Arbor Triſte *ſheds its Flowers at the riſing of the Sun, and ſhoots them again at the ſetting of the Sun? And whether the diſtill'd Water thereof* (*call'd* Aqua di Mogli *by the* Portugals) *may not be tranſported to* England? *And whether at the riſing of the Sun the Leaves of the* Arbor Triſte *drop off as well as the Flowers?*

*A.* There are two ſorts of the *Arbor Triſte*; one is called by the *Portugals Triſte de Die*, the other *Triſte de Nocte*; the one ſheds its Flowers at the riſing, the other at the ſetting of the Sun; but neither of them ſhed their Leaves. There is no Body here that underſtands the diſtilling of Waters; ſome ſay this *Aqua di Mogli* is to be had at *Malaca*, for which I have writ, and ſhall ſend it if procurable.

Q. 14. *Whether the* Arbor de Rays, *or Tree of Root, propagate itſelf in a whole Foreſt, by ſhooting up and*

*letting fall Roots from its Branches into the Ground, that ſpring up again, and ſoon?*

*A.* This is true. And we have diverſe Trees about *Batavia*, and the like adjacent Iſlands, above fifty Foot in the Diameter.

Q. 15. *What kind of Fruit is that in* Jucca, *which grows immediately out of the Trees's Body; and is ſaid to breed the* Plague *if eaten immoderately?*

*A.* It is a Fruit much like to *Durion*, which groweth in the ſame Manner; hath a faint Smell, and ſweet wateriſh Taſte; for my part I do not affect them: The *Plague* is a Diſeaſe unknown amongſt the *Indians*; but this Fruit, as moſt others do, immoderately eaten, cauſes a *Diarhea*, which eaſily degenerates to a *Teneſmus*, by us called *Peirſing*, a dangerous Sickneſs, and worſe than the *Plague*.

Q. 16. *What Poiſon is it the King of* Macaſſar *in* Colebees *is ſaid to have particular to himſelf, which not only kills a Man immediately, that hath received the ſlighteſt Wound by a Dart dipt therein, but alſo within half an Hour's time, makes the Fleſh, touched with it, ſo rotten, that it will fall like Snivel from the Bones, and whoſe poyſonous Steam will ſoon fly up to a Wound made with an unpoiſoned Dart, if the Blood be only in the ſlighteſt Manner touch'd with a Dart infected with the Poiſon? What Certainty there is of this Relation?*

*A.* That there is ſuch a Poiſon in this King's Poſſeſſion is moſt certain; but what it is, no *Chriſtian* hitherto ever knew right. By the Government of *Arnold de Flamminge Van Outſhorn* diverſe have been tortured; yea, killed.

Some ſay it is the Gall of a venomous Fiſh, others ſay it is a Tree which is ſo venomous, that thoſe who

are

are condemned to die, fetch the Poiſon, but not one of an Hundred ſcapes Death; the Roots of this Tree are held an Antidote againſt the Poiſon; but our People, when we had War with *Macaſſar*, found no Antidote like to their own or other's Excrements; as ſoon as they felt themſelves wounded, they inſtantly took a Doſe of this ſame, which preſently provoked to vomit, and ſo, by Repulſion, (as I perceive) and Sweat, freed the noble Parts from farther Infection. That a Wound ſhould be infected by this Poiſon, tho' not inflicted by an impoiſoned Weapon, is not ſtrange to thoſe who ſtudy Sympathy; and ſet Belief in that much renowned ſympathetical Powder of Sir *Kenelm Digby*. Yet ſuch Effects of the *Macaſſars* Arts are unknown to us.

Q. 17. *Whether in* Pegu *and other Places in the* Eaſt-Indies, *they uſe a Poiſon that kills by ſmelling, and yet the Poiſon-Smell is hardly perceived?*

To this no Anſwer was return'd.

Q. 18. *Whether* Camphire *comes from Trees? What kind of Trees they are in* Borneo, *that are ſaid to yield ſuch excellent* Camphire, *as that one Pound thereof is ſaid to be worth an Hundred of that of* China *and other Places?*

*A. Camphire* comes from Trees of an exceſſive Bulk, as you may ſee by the Cheſts which come from *Japan* into *Europe*, made of the ſame Wood of *Borneo*; it comes likewiſe from Trees, which are ſaid to ſtand in ſandy Ground, and drop like a Gum.

But of late an Experiment is found in *Ceylon*, that the Root of a Cinnamon Tree yields as good *Camphire*, as either *Japan*, or *China*, of which I ſhall ſend you a Pattern, being now to be had at preſent here; as alſo an Oil extracted from the ſame Roots, which

reſerves

reserves something of the Cinnamon-smell; but that may be the Fault of the Distiller.

Q. 19. *Whether some of that rare Wood, call'd* Palo d'Aquila *and* Calamba, *of an extraordinary Value, even in the Country where it groweth, as in* Siam *about* San, *and* Patan, *and in* Cochinchina, *may not be brought over; as also some of those strange Nests of* Cochinchina, *made by Birds upon Rocks, of a certain viscous Froth of the Sea, which Nests grown dry and hard, are said to become transparent; and when dissolved in Water, serve excellently to season all their Meats?*

*A.* If the Question be made, whether these Things may be brought over by Permission of the Company? I answer; as first, that their Laws forbid the Transportation of all whatsoever, whether necessary to the Conservation of Health, or Acquisition of Wealth, or Rarities, *&c.* but if the *Query* be concerning the Nature and Substance of the Wood and Nests; they are transportable, and can subsist without decaying many Years. *Lignum Aquilæ* is far inferior to *Calamba*, though not easy to be discerned. A Pound of *Calamba* is worth in *Japan* thirty, and sometimes forty Pounds Sterling; the best comes from *Cambodia*, and seems to be the Pith of the Tree *Aquila* in *Japan*; it is used as Incense to perfume Clothes, and Chambers. It is held for a great Cordial, and commonly us'd by that Nation, as also the *Chinese*, in *Defectione spirituum vitalium*; as in *Paralysi & Nervorum laxatione & impotentia:* They rub it with *Aqua Cynamomi* upon a Stone, till the Substance of the Wood is mixt, *sicut pulpa*, with the Water, and so drink it with Wine, or what they please. The Bird's Nests are a great Restorative to Nature, and much used by the lecherous *Chinese*.

Q. 20.

Q. 20. *Whether the Animal call'd* Abados, *or* Rhinoceros, *hath Teeth, Claws, Fleſh, Blood, and Skin, yea his very Dung and Water, as well as his Horns, antidotal? And whether the Horns of thoſe Beaſts be better or worſe, according to the Food they live upon.*

*A.* Their Horns, Teeth, Claws, and Blood are eſteemed Antidotes, and have the ſame Uſe in the *Indian Pharmacopeia* as the *Theriaca* hath in ours; the Fleſh I have eaten is very ſweet and ſhort. Some Days before the Receipt of your Letter, I had a young one no bigger than a Spaniel Dog, which followed me wherever I went, drinking nothing but *Buffalo* Milk, lived about three Weeks, then his Teeth began to grow, and he got a Looſeneſs and died. 'Tis obſerved, that Children (eſpecially of *European* Parents) at the breaking out of their Teeth are dangerouſly ſick, and commonly die of the ſcouring in theſe Parts. His Skin I have cauſed to be dried, and ſo preſent it unto you, ſince Fate permits not to ſend him you living; ſuch a young one was never ſeen before. The Food I believe is all one to this Animal, being that they are ſeldom ſeen but amongſt withered Branches, Thiſtles and Thorns; ſo that the Horn is of equal Virtue.

Q. 21. *Whether the falſifying of the* China *Musk is not rather done by mixing Oxen and Cow's Livers dried and pulveriſed with ſome of the putrified and concrete Fleſh and Blood of the* China *Musk-cat, than by beating together the bare Fleſh and Blood of this Animal,* &c.

Not anſwer'd.

Q. 22. *Whether there be two Sorts of* Gumlac, *one produced from a certain winged* Ant, *the other the* Exudation *of a Tree; the firſt had in the Iſlands*

*of* Suachan, *the last in the Kingdom of* Martaban?

*A.* We know of none but such as drop from Trees, and come from diverse Places in *Siam*, *Cambodia*, *Pegu*, &c.

Q. 23. *If the best* Ambergrease *be found in the Islands* Socotora *and* Aniana, *near* Java? *To endeavour the getting of more certain Knowledge, what it is; being reported to be bred in the Bottom of the Sea like to a thick Mud?*

*A.* The best that is in the World comes from the Island *Mauritius*: and is commonly found after a Storm. The Hogs can smell it at a great Distance; who run like mad to it, and devour it commonly before the People come to it. It is held to be a *Zeequal* Viscosity, which being dried by the Sun, turns to such a Consistence as is daily seen. Father *Myavines Isaac Vigny* a *French* Man in *Oleron*, hath been a great Traveller in his Time; and he told me, he sailed once in his Youth through so many of these *Zeequalen*, as would have loaden ten thousand Ships; the like having been never seen: His Curiosity did drive him to take up some of those, which being dried in the Sun, were perceived to be the best *Ambergrease* in the World. I have seen one Piece which he kept for a *Memento*, and another Piece he sold for a 1300 *lib.* sterl. This being discovered, they set sail to the same Place where these *Zeequalen* appeared, and cruised there, to and fro, for the space of six Weeks, but could not perceive any more. Where this Place is situated, I do not know; but Monsieur *Gentillot*, a *French* Captain in *Holland*, can tell you.

Q. 24. *To enquire of the Divers for Pearls staying long under Water, whether they do it by the assistance of*

*any*

*any thing they carry with them, or by long and often Use get a Trick of holding their Breath so long, at the Isle of* Bahaaen *near* Ormus?

*A.* What they do at *Baharen* is unknown to me, but since we have had *Tute Corein* in *Ceylon,* where very good Pearls grow, I hear the *Divers* use no Artifice. The manner is thus; at a set time of the Year Merchants come from all Parts, as likewise *Divers* with their Boats; each Boat hath a certain Quantity of square Stones, upon which Stones the *Divers* go down, and give a Token to their Companions, when they think it time to be hal'd up; each Stone pays Tribute to the Company. The Oyster or Shell-Fish is not immediately open'd, but laid on Heaps, or in Holes at the Sea-side. When the diving Time is ended, the Merchants come and buy these Heaps, according as they can agree, not knowing whether they shall get any thing or no. So that this is a meer Lottery. This Pearl-fishing is dangerous, being the *Divers* commonly make their Will, and take Leave of their Friends, before they tread the Stone to go down.

Q. 25. *Whether Cinnamon when first gathered hath no Taste at all, but acquires its Taste and Strength by fifteen Days sunning? And whether the Bark be gathered every two Years in the Isle of* Ceylon?

*A.* The Cinnamon Tree as it groweth is so fragrant, that it may be smelt a great Way off before it be seen. And hath even then, a most excellent Taste; so that by sunning it loseth rather than acquires any Taste or Force; the Tree being pill'd is cut down to the Root; but the young Sprigs after a Year or two give the best and finest Cinnamon.

Q. 26. *To learn, if it may be, what Art the Master-workmen of* Pegu *have to add to the Colour of their Rubies?*

*A.* Not answered.

Q. 27. *To inquire after, and get, if possible, some of the Bones of the Fish called* Caballa, *which are so powerful in stopping Blood.*

*A.* 'Tis done, and they shall follow with the *Dutch* Ships.

Q. 28. *Whether at* Hermita, *a Town in* Ethiopia, *there are Tortoises so big, that Men may ride upon them?*

*A.* It is reported, that there be extraordinary great ones there; I have seen some Sea Tortoises here, of four Foot broad, in oval Form, very low leg'd, but of that Strength, that a Man may stand on one: The manner of catching them, is to turn them with a Fork upon their Backs.

Q. 29. *Whether there be a Tree in* Mexico, *that yields Water, Wine, Vinegar, Oil, Milk, Honey, Wax, Thread and Needles?*

*A.* The *Cokos* Tree yields all this and more; the Nut, while it is green, hath very good Water in it; the Flower being cut, drops out great Quantity of Liquor, called *Sury*, or *Teywack*, which drank fresh, hath the Force, and almost the Taste of Wine; grown sour, is very good Vinegar; and distilled, makes very good Brandy, or *Areck*: The Nut grated, and mingled with Water, tasteth like Milk; pressed, yields very good Oil: Bees swarm in these Trees, as well as in others; Thread and Needles are made of the Leaves and tough Twigs. Nay, to add something to this Description; in *Amboyna*, they make Bread of the Body of the Tree, the Leaves serve to thatch Houses, and likewise sails for their Boats.

Q. 30. *Whether about* Java, *there be Oysters of that vast Bigness, as to weigh three hundred Weight?*

*A.*

*A.* I have ſeen a Shell Fiſh, but nothing like an Oyſter, of ſuch a Bigneſs, the Fiſh being ſalted, and kept in pickle, afterwards boiled, taſteth like Brawn in *England*, and is of an horny Subſtance.

Q. 31. *Whether near* Malacca, *there be found in the Gall of certain Swine, a Stone eſteemed incomparably above* Bezoar?

*A.* In that Country, but very ſeldom, there grows a Stone in the Stomach of a *Porkapine*, called *Pedro Porco*; of whoſe Virtue there are large Deſcriptions; and the *Hollanders* are now ſo fond, that I have ſeen 400 Dollars of ⅝ given for one no bigger than a Pigeon's Egg. There is Sophiſtication as well in that as *Bezoar*, *Muſk*, *&c.* and every Day new Falſhood, ſo that I cannot well ſet down here any Rules, but muſt be judged by Experience. A falſe one I ſend you, which doth imitate very near in Virtue the true one, but is a great deal bigger, and of another Colour.

As for the Obſervations deſired of the Iſlands St. *Helena*, and *Aſcenſion*, they may be better made by the *Engliſh Eaſt-India* Men, who commonly touch at both Places; but the *Hollanders* never, or very ſeldom.

Q. 32. *Whether it be Winter at the Eaſt-ſide of the Mountain* Gates, *which come from the North to Cape* Comoryn, *whilſt it is Summer on the Weſt-ſide? and* Vice verſa.

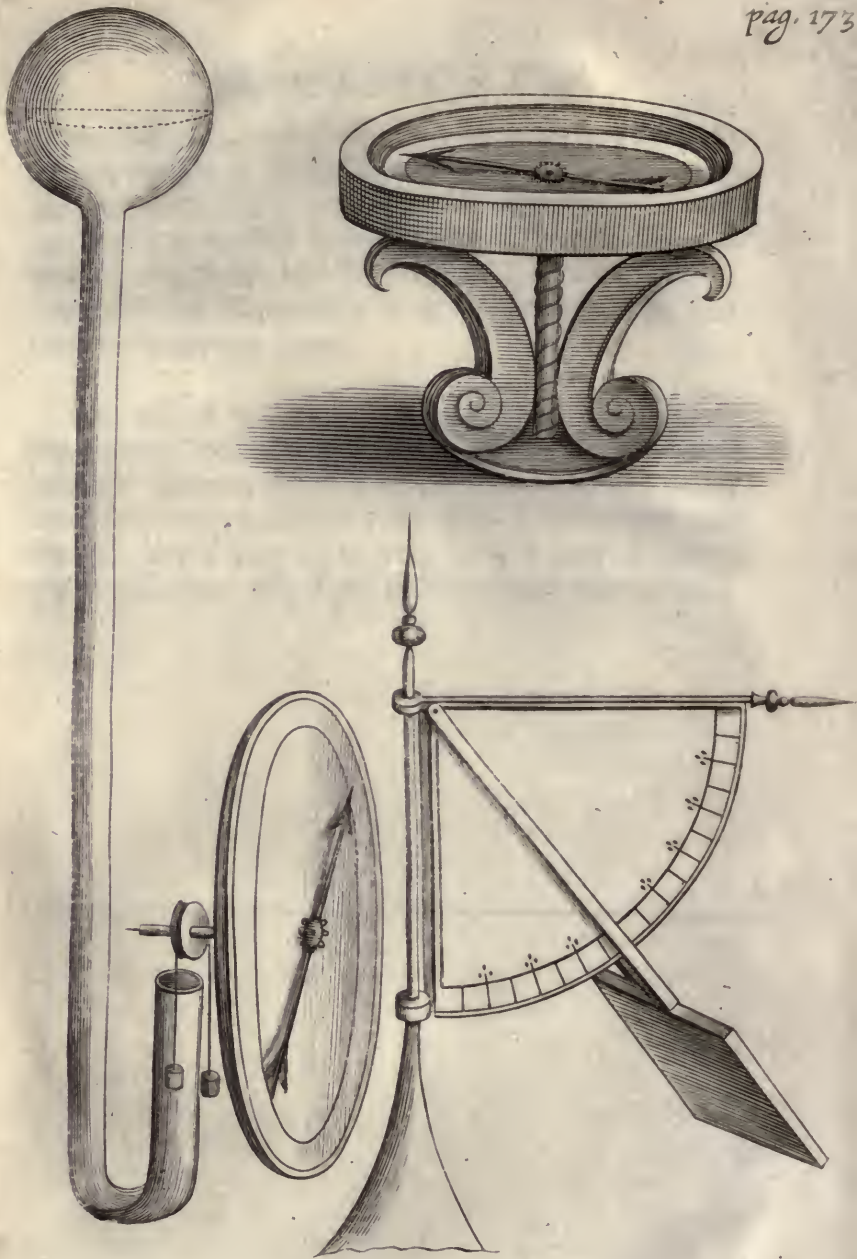
*A.* Not only there, but likewiſe on the Iſland of *Zeylon*.

Q. 33. *In what Country* Lignum Aloes *is found, whether it be the Wood of a Tree? or the Root of a Tree? How to know the beſt of the Kind?*

*A. Lignum Aloes, Lignum Paradiſi, Calamba*, are *Synonyma*, the ſame: and the ſame Wood comes moſt

from *Cambodia*, and *Siam*; but they ſay it is brought by the People of *Lawlan*, a Country about *Cambodia*, whence *Musk*, and *Benzoin*, and moſt *Aromata* come; it is eaſily diſtinguiſhed from other Wood by its ſtrong Scent and Richneſs of Balm in it, which appears in its Blackneſs; it is of great Value, and hard to be gotten here.

The reſt of the *Queries* are not anſwered, becauſe the Time is ſhort ſince I received them, and eſpecially, becauſe I cannot meet with any one that can ſatisfy me, and being unſatisfied my ſelf, I cannot nor will obtrude any Thing upon you, which may hereafter prove fabulous, but ſhall ſtill ſerve you with Truth.



A

# METHOD

## For making a Hiſtory of the WEATHER.

## By Mr. *HOOK.*

" FOR the better making a Hiſtory of the Weather, I conceive it requiſite to obſerve,

" 1. The Strength and Quarter of the Winds, and " to regiſter the Changes as often as they happen; " both which may be very conveniently ſhewn, by " a ſmall Addition to an ordinary Weather-cock.

" 2. The Degrees of Heat and Cold in the Air; " which will be beſt obſerved by a ſealed *Thermometer*, graduated according to the Degrees of *Expanſion*, which bear a known Proportion to the " whole Bulk of Liquor, the beginning of which " Gradation, ſhould be that Dimenſion which the Liquor hath, when encompaſſed with Water, juſt beginning to freeze, and the Degrees of *Expanſion*, " either greater or leſs, ſhould be ſet or marked above it, or below it.

" 3. The Degrees of Dryneſs and Moiſture in the " Air; which may be moſt conveniently obſerved by " a *Hygroſcope*, made with the ſingle Beard of a wild " Oat perfectly ripe, ſet upright and headed with an " *Index*, after the Way deſcribed by *Emanuel Magnan*; the Converſions and Degrees of which may be " meaſured by Diviſions made on the rim of a Circle, in

" the

" the *Center* of which, the *Index* is turned round:
" The Beginning or Standard of which Degree of
" *Rotation*, ſhould be that, to which the *Index* points,
" when the Beard, being throughly wet, or covered
" with Water, is quite unwreathed, and becomes
" ſtrait. But becauſe of the Smalneſs of this Part
" of the Oat, the Cod of a wild *Vetch* may be uſed
" inſtead of it, which will be a much larger *Index*,
" and will be altogether as ſenſible of the Changes
" of the Air.

" 4. The Degrees of Preſſure in the Air; which
" may be ſeveral Ways obſerved, but beſt of all with
" an Inſtrument with Quick-ſilver, contrived ſo, as
" either by means of Water, or an *Index*, it may ſen-
" ſibly exhibit the minute Variations of that Action.

" 5. The Conſtitution and Face of the Sky or Hea-
" vens; and this is beſt done by the Eye; here ſhould
" be obſerved, whether the Sky be clear or clouded;
" and if clouded, after what Manner; whether with
" high Exhalations or great white Clouds, or dark
" thick ones. Whether thoſe Clouds afford Fogs or
" Miſts, or Sleet, or Rain, or Snow, *&c.* Whether
" the under ſide of thoſe Clouds be flat or waved and
" irregular, as I have often ſeen before Thunder.
" Which way they drive, whether all one Way, or
" ſome one way, ſome another, and whether any of
" theſe be the ſame with the Wind that Blows be-
" low; the Colour and Face of the Sky at the riſing
" and ſetting of the Sun and Moon; what Haloes or
" Rings may happen to encompaſs thoſe Luminaries,
" their Bigneſs, Form and Number.

" 6. What Effects are produc'd upon other Bo-
" dies: As what Aches and Diſtempers in the Bodies
" of Men; what Diſeaſes are moſt rife, as Colds, Fe-
" vers,

" vers, Agues, *&c.* What Putrefactions or other " Changes are produc'd in other Bodies; as the ſweat- " ing of Marble, the burning blue of a Candle, the " blaſting of Trees and Corn; the unuſal Sprouting, " Growth, or Decay of any Plants or Vegetables; the " Putrefaction of Bodies not uſual; the Plenty or " Scarcity of Inſects; of ſeveral Fruits, Grains, Flow- " ers, Roots, Cattel, Fiſhes, Birds, any thing notable of " that Kind. What Conveniences or Inconveniences " may happen in the Year, in any kind, as by Floods, " Droughts, violent Showers, *&c.* What Nights pro- " duce Dews and Hoar-Froſts, and what not?

" 7. What Thunders and Lightnings happen, and " what Effects they produce; as ſouring Beer or Ale, " turning Milk, killing Silkworms, *&c?*

" Any thing extraordinary in the Tides; as double " Tides, later or earlier, greater or leſs Tides than " ordinary, riſing or drying of Springs; Comets or " unuſual Apparitions, new Stars, *Ignes fatui* or " ſhining Exhalations, or the like.

" Theſe ſhould all or moſt of them be diligently " obſerved and regiſtred by ſome one, that is always " converſant in or near the ſame Place.

" Now that theſe, and ſome others, hereafter to be " mentioned, may be regiſtred ſo as to be moſt con- " venient for the making of Compariſons, requiſite " for the raiſing *Axioms*, whereby the Cauſe or Laws " of Weather may be found out; it will be deſire- " able to order them ſo, that the Scheme of a whole " Month may at one View be preſented to the Eye: " And this may conveniently be done on the Pages of " a Book in *Folio*, allowing fifteen Days for one ſide, " and fifteen for the other. Let each of thoſe Pages " be divided into nine Columns, and diſtinguiſhed by

" perpendicular Lines; let each of the first six Co-
" lumns be half an Inch wide, and the three last equal-
" ly share the remaining of the Side.

" Let each Column have the Title of what it is to
" contain, in the first at least, written at the Top of
" it: As, let the first Column towards the left hand,
" contain the Days of the Month, or Place of the
" Sun, and the remarkable Hours of each Day. The
" second, the Place, Latitude, Distance, Ages and
" Faces of the Moon. The third, the Quarters and
" Strength of Winds. The fourth, the Heat and
" Cold of the Season. The fifth, the Dryness and
" Moisture of it. The sixth, the Degrees of Pressure.
" The seventh, the Faces and Appearances of the
" Sky. The eighth, the Effects of the Weather upon
" other Bodies, Thunders, Lightnings, or any thing
" extraordinary. The ninth, general Deductions,
" Corollaries or Syllogisms, arising from the com-
" paring the several *Phænomena* together.

" That the Columns may be large enough to con-
" tain what they are designed for, it will be necessary,
" that the Particulars be expressed with some Cha-
" racters, as brief and compendious as is possible.
" The two first by the Figures and Characters of the
" Signs commonly used in Almanacks. The Winds
" may be exprest by the Letters, by which they are
" exprest in small Sea-Cards; and the Degrees of
" Strength, by 1, 2, 3, 4, *&c.* according as they are
" marked in the Contrivance in the Weather-cock.
" The Degrees of Heat and Cold may be exprest by
" the Numbers appropriate to the Divisions of the
" *Thermometer*. The Dryness and Moisture, by the
" Divisions in the Rim of the *Hydroscope*. The Pres-
" sure by Figures, denoting the Height of the *Mercu-*

" *rial*

" *rial Cylinder.* But for the Faces of the Sky, they " are ſo many, that many of them want proper Names; " and therefore it will be convenient to agree upon " ſome determinate ones, by which the moſt uſual " may be in brief expreſt. As let *Clear* ſignify a very " clear Sky without any Clouds or Exhalations: " *Checquer'd* a clear Sky, with many great white round " Clouds, ſuch as are very uſual in Summer. *Hazy*, " a Sky that looks whitiſh, by Reaſon of the Thick- " neſs of the higher Parts of the Air, by ſome Exhala- " tions not formed into Clouds. *Thick*, a Sky more " whiten'd by a greater Company of Vapours: theſe do " uſually make the *Luminaries* look bearded or hairy, " and are oftentimes the Cauſe of the Appearance of " Rings and Haloes about the *Sun* as well as the *Moon*. " *Overcaſt*, when the Vapours ſo whiten and thicken " the Air, that the *Sun* cannot break through; and of " this there are very many Degrees, which may be ex- " preſt by a *little, much, more, very much overcaſt*, &c. " Let *Hairy* ſignify a Sky that hath many ſmall, thin, " and high Exhalations, which reſemble Locks of Hair, " or Flakes of Hemp or Flax; whoſe Varieties may " be expreſt by *ſtrait* or *curv'd*, *&c.* according to the " Reſemblance they bear. Let *Water'd* ſignify a Sky " that has many high thin and ſmall Clouds, looking " almoſt like water'd Tabby, call'd in ſome Places a " Mackrel Sky. Let a Sky be call'd *Wav'd*, when " thoſe Clouds appear much bigger and lower, but " much after the ſame manner. *Cloudy*, when the Sky " has many thick dark Clouds. *Lowring*, when the " Sky is not very much overcaſt, but hath alſo under- " neath many thick dark Clouds which threaten " Rain. The Signification of *gloomy, foggy, miſty, fleet-* " *ing, driving, rainy, ſnowy*, Reaches or Racks *va-*

" *riable, &c.* are well known, they being very com-
" monly uſed. There may be alſo ſeveral Faces of
" the Sky compounded of two or more of theſe,
" which may be intelligibly enough expreſt by two
" or more of theſe Names. It is likewiſe deſirable,
" that the Particulars of the eighth and ninth Co-
" lumns may be entred in as little Room and as few
" Words as are ſufficient to ſignify them intelligibly
" and plainly.

" It were to be wiſht that there were diverſe in
" ſeveral Parts of the World, but eſpecially in diſtant
" Parts of this Kingdom, that would undertake this
" Work, and that ſuch would agree upon a common
" Way ſomewhat after this Manner, that as near as
" could be, the ſame Method and Words might be
" made Uſe of. The Benefit of which Way is ea-
" ſily enough conceivable.

" As for the Method of uſing and digeſting thoſe
" ſo collected Obſervations; that will be more ad-
" vantageouſly conſidered when the *Supellex* is pro-
" vided; a Workman being then beſt able to fit
" and prepare his Tools for his Work, when he ſees
" what Materials he has to work upon.

A

# SCHEME,

AT ONE

View representing to the Eye the Observations of the WEATHER for a Month.

| Days of the Month and Place of the Sun. | Remarkable Houles. | Age and Sign of the Moon at Noon. | The Quarters of the Wind and its Strength. | The Degrees of Heat and Cold. | The Degrees of Dryness and Moisture. | The Degrees of Pressure. | The Faces or visible Appearances of the Sky. | The notablest Effects. | General Deductions to be made after the Side is fitted with Observations: As, |
|---|---|---|---|---|---|---|---|---|---|
| | 4 | | W. 2 | 9 3/10 | 2 5 | 29 1/10 | Clear Blue, | A great Dew | From the last Q. of the *Moon* to the Change he Weather was very temperate, but cold for the Season; the Wind pretty constant between N. & W. A little before the last great Wind, and till the Wind rose at its highest, the Quick-silver continued descending till it came very low; after which it began to reascend, &c. |
| | 8 | 27 | 3 1/2 | 12 1/2 | | | but Yellowish | Thunder, far | |
| 14 | 12 | ☌ 9.46 | 3 1/3 | 16 | 2 8 | | in the N. E | to the South. | |
| ♓ | | | | | | 29 1/5 | clouded toward the S. | A very great | |
| | 4 | | | | | | checker'd | Tide. | |
| 12.46 | 8 | Perigeu. | | 10 1/2 | 2 9 | | Blue. | | |
| | 12 | | W. SW. 1 | 7 1/2 | | 22 3 | | | |
| | 8 | | N. W. 3 | 9 | 28 1/1 | 29 1/10 | A clear Sky | Not by much | |
| 15 | | | 4 | | | | all Day, but a | so big a Tide | |
| ♓ | 4 | 28 | N. 2 | 8 1/2 | 2 9 | | little check- | as Yesterday. | |
| 13.40 | 5 | ☌ 24.51 | 1 | | | | er'd at 4. P.M. | Thunder in | |
| | 10 | | | 7 | 2 10 | 29 | at Sun-set red | the North. | |
| | | | | | | | and hazy. | | |
| | 10 | N Moon | S. 1 | 10 | 10 | 28 1/2 | Overcast and | No Dew upon | |
| 16 | | at 7. 25 | | | | | very lowering. | the Ground, | |
| ♓ | | A. M. | | | | | | but very | |
| 14.37 | | ♓ 10.8 | | | | | | much upon | |
| | | | | | | | | Marble-stones | |
| | | &c. | &c. | &c. | &c. | &c. | &c. | &c. | |

# DIRECTIONS

FOR THE

## Obſervations of the Eclipſes of the Moon.

## By Mr. *ROOKE.*

" ECliſes of the Moon are obſerv'd for two prin-
" cipal Ends; one *Aſtronomical*, that by com-
" paring Obſervations with Calculations, the *Theory*
" of the *Moon*'s Motion may be perfected, and the Ta-
" bles thereof reform'd: The other *Geographical*,
" that by comparing among themſelves Obſervations
" of the ſame *Ecliptical Phaſes*, made in diverſe
" Places, the Difference of *Meridians*, or *Longitudes*
" of thoſe Places, may be diſcover'd.

" The Knowledge of the *Eclipſe*'s Quantity and
" Duration, the Shadows, Curvity and Inclination,
" *&c.* conduce only to the former of theſe Ends:
" The exact Time of the Beginning, Middle, and
" End of the *Eclipſes*, as alſo in total ones, the Be-
" ginning and End of total Darkneſs, is uſeful for both
" of them.

" But becauſe theſe Times conſiderably differ in
" Obſervations made by the bare Eye, from thoſe with
" a *Teleſcope*, and becauſe the Beginning of *Eclipſes*
" and the End of total Darkneſs are ſcarce to be ob-
" ſerv'd exactly, even with Glaſſes; one not being a-
" ble clearly to diſtinguiſh between the true Shadow
" and *Penumbra*, unleſs one have ſeen, for ſome time
" before, the Line, ſeparating them, paſs along upon

" the

" the Surface of the *Moon*: And laſtly, becauſe in " ſmall partial *Eclipſes*, the Beginning and End (and " in total ones of ſhort Continuance in the Shadow, " the Beginning and End of total Darkneſs) are un- " fit for nice Obſervations, by Reaſon of the ſlow " Change of Appearances, which the oblique Motion " of the Shadow then cauſeth: For theſe Reaſons I " ſhall propound a Method particularly deſigned for " the Accompliſhment of the *geographical* End in " obſerving *Lunar Eclipſes*, free (as far as is poſſible) " from all the mention'd Inconveniences. For,

" Firſt, It ſhall not be practicable without a *Tele-* " *ſcope*.

" Secondly, The Obſerver ſhall always have Op- " portunity, before his principal Obſervation, to note " the Diſtinction between the true Shadow and *Pen-* " *umbra*.

" Thirdly, It ſhall be applicable to thoſe Seaſons " of the *Eclipſe*, when there is the ſuddeneſt Altera- " tion in the Appearances. To ſatisfy all which In- " tents;

" Let there be of the eminenteſt Spots, diſperſed " over all Quarters of the *Moon*'s Surface, a ſelect " Number generally agreed on, to be conſtantly made " uſe of to this Purpoſe, in all Parts of the World: " As for Example, thoſe which *Hevelius* calleth

" *Mons* { *Sinai*, *Ætna*, *Porphyrites*, *Serrorum* } *Inſula* { *Besbicus*, *Creta* } *Palus* { *Mæotis*, *Maræotis*. }

*Lacus Niger Major.*

" Let in each *Eclipſe* (not all, but for inſtance) " three of theſe Spots, which then lye neareſt to the " *Ecliptic*, be exactly obſerv'd, when they are firſt " touched by the true Shadow, and again when they " are juſt completely entred into it; and (if you " pleaſe) alſo in the Decreaſe of the *Eclipſe*, when " they are firſt fully clear from the true Shadow: " For the accurate Determination of which Mo- " ments of Time (that being in this Buſineſs of main " Importance) let there be taken *Altitudes* of re- " markable fixed Stars, on this ſide the Line, of " ſuch as lye between the *Æquator* and *Tropic* of " *Cancer*; but beyond the Line, of ſuch as are ſi- " tuated towards the other *Tropic*; and in all Pla- " ces, of ſuch, as at the time of Obſervation, are " about four Hours diſtant from the *Meridian*.

Mr.

# Mr. *ROOKE*'s DISCOURSE

## Concerning the Obſervations of the Eclipſes of the *Satellites* of *Jupiter*.

*LOngitudinis ſive Differentiæ Meridianorum ſcientia eſt vel Nautica, vel Geographica.*

*Illa Navis aquæ innatantis; Hæc Urbium, Inſularum, Promontoriorum, &c. Globo terreſtri adhærentium ſitum inveſtigat.*

*In Navi, motu vario ſubinde tranſlatâ, Obſervatio identidem eſt repetenda; at loci terreni, fixam perpetuò ſedem obtinentis, poſitionem ſemel determinâſſe ſufficit.*

*Maria, fluctibus ut plurimum agitata, ſubtilem Inſtrumentorum, præſertim Teleſcopii longioris tractationem minime permittunt.*

*Longitudinis ſcientia Nautica vix unquam de Cælo expectanda; Geographica vero ab Eclipſibus Corporum cœleſtium præcipuè petenda.*

*Eclipſes ſunt vel* { *Veteribus notæ, ſcil. Solis & Lunæ, Satellitum Jovis, ante Tubi Optici uſum incognitæ.*

*(Miſſam fecimus Cl. Hugenii Lunulam Saturniam Obſervatu difficiliorem.)*

*Illarum per multa retro ſæcula Obſervationes; nè duo quidem loca quantum Meridianorum intercapidinem habeant, ſatis certò definitum eſſe experimur; harum verò per pauculos annos adhibendâ diligenti animadver-*

*verſione; præcipuæ totius terrarum Orbis partes, quomodo ad ſe invicem ſitæ ſint, accuratius determinatum iri non deſperamus.*

*Cauſæ, ob quas minùs in hoc negotio præſtitêre Eclipſes Luminarium.*

*Sunt* { 1. *Communis utriſque, ipſarum Raritas*
*Propria* { 2. *Solari, Parallaxis Lunæ.*
{ 3. *Lunari, Penumbra Terræ.*

*His ergo præferimus Satellitum Jovialium Defectus frequentiſſimos, ſine ulla Parallaxi, in quibus etiam Penumbra Jovis prodeſſe magis, quam officere videtur.*

*Methodus Longitudinis, ex Eclipſibus vel aliis Phænomenis cæleſtibus, indagandæ duplex eſt: Una, cum Tempore ad Meridianum Tabularum proprium ſupputato, Tempus alibi obſervatum; Altera, Tempora variis in locis obſervata, inter ſe comparat.*

*Cum Arti nauticæ prior illa unicè interſerviat, quæ Motus cæleſtes accuratiùs multò, quam nobis ſperandum videtur, cognitos ſupponit; ob Aſtronomiæ Imperfectionem, & Obſervationum marinarum Hallucinationem perpetuo ferè neceſſariam: ſupra pronunciavimus Longitudinis Scientiam nauticam vix unquam de Cælo expectandam.*

*Methodus altera, Geographiæ perficiendæ idonea, cum non aliam ob cauſam prævium Calculum adhibeat, niſi ut eo moniti plures, eidem Phænomeno, in diſſitis locis, obſervando ſimul invigilent; Periodorum atque Epocharum ἀκρίβειαν minime deſiderat.*

*Satellites Jovis numero ſunt quatuor, varia apud Authores Nomina ſortiti; nos ex diverſis, quæ a Jove obtinent Intervallis, 1. Intimum, 2. Penintimum, 3. Penextimum, 4. Extimum appellabimus.*

*Horum*

*Horum non niſi uniuſmodi* Φαινόμενον *obſervandum proponimus; Immerſionem nempè in Umbram Jovis ſive ipſum Eclipſεως initium.*

*Solam hanc* Φάσιν *ſeligimus, utpote in indiviſibili ferè conſtitutam: Licet enim Luminis Languor atque Diminutio Moram aliquantulam trahere poſſit, omnimoda tamen Extinctio & Evaneſcentia (de qua unicè ſoliciti ſumus) Momento quaſi contingere deprehendetur.*

*Ante* ♂ ☉ ♃ *Satellites ad Occidentem, Diſci Jovialis Reſpectu, in Deliquia incidunt; poſt Acronychia, ad Orientem.*

*Intimi & (niſi fortè rariſſimè) penintimi Eclipſεων tantum Occidentalium Initia nobis apparere poſſunt: duorum autem remotiorum multa etiam Orientalium Exordia conſpicere licet.*

*Defectus Medicæorum obſervatu faciliores reddant.* 1. *Major Planetarum Claritas.* 2. *Motus ipſorum tardior.* 3. *Penumbra Jovis craſſior.* 4. *Longius à Joviali Diſco intervallum: ad Obſervationum* ἀκριβείαν *conducit.* 1. *Motus Satellitum velocior.* 2. *Penumbra Jovis anguſtior.*

*Hæc omnia nobiſcum meditati, ſubductâ benè ſingulorum Ratione, Satellitum intimum & penextimum ad Rem noſtram præ cæteris accommodatos; atque adeo, cum ſatis frequentes ſint ipſorum Eclipſes, ſolos adhibendos eſſe judicamus.*

*Extimum omninò negligimus, utpotè minimum omnium & obſcuriſſimum; præſertim verò quod tantâ nonnunquam ſit Latitudine præditus, ut Umbra Jovis ipſum Aphelium neutiquam attingat.*

*Penintimus autem nullâ gaudet ex ſuprà recenſitis Prærogativâ, quæ alterutri ſaltem eorum, quos jam prætulimus, potiori Jure non debeatur.*

*Maxima Satellitum in Umbra incidentium à Limbo*

*Disci Jovialis Distantia, unâ aut alterâ, post priorem Solis & Jovis Quadraturam, Hebdomadâ contingit.*

*Estque ea penextimi Sesquidiametro Jovis ferè æqualis: Intimi verò Semidiametro ejusdem non multò major, sextâ ante memoratam Quadraturam Hebdomadâ. Penextimus Umbram ingrediens Diametro Jovis à Disco abest: Augendâ indè usque ad maximam Distantiâ, Incremento non uniformi, sed continuè decrescente.*

*Hinc iisdem reciprocè passibus (Decremento sc. sensim increscente) diminuitur istiusmodi Intervallum, ad bimestre usque Tempus à dictâ Quadraturâ elapsum, quando iterum Diametro Joviali æquatur.*

*Posteà autem usque ad ipsa Acronychia, penextimus Umbram subiturus, æquabili ferè Gradu (singulis nempe Hebdomadis Quadrante Diametri) promotus, ad Limbum Jovis accedit. Intimi, pro diverso Jovis ad Solem Situ, Distantia eâdem planè ratione variatur: ejus enim, quam ubique obtinet, penextimus, Trienti fere perpetuo est æqualis.*

*Mense circiter post Jovem Scli oppositum, penextimus (Intimi post ☌ ☉ ♃, Immersiones observari non posse supra innuimus) simulac Corporis Jovialis Limbum orientalem transierit, occidentalem Umbra continuo intrabit.*

*Inde augetur paulatim penextimi evanescentis Distantia, donec unâ aut alterâ ante posteriorem Quadraturam Hebdomadâ, maxima evadat; quando à Disci Jovialis Margine Semidiametro ejusdem removetur.*

*Postquam autem hucusque diminutâ sensim Velocitate, Umbra Jovis ab ipsius Disco recessit: hinc, Motu continuè accelerato, ad eundem redit.*

*Per bimestre ante & post Jovis cum Sole Conjunctionem Spatium, in Locis Longitudine multum differentibus, eadem Eclipsis apparere nequit: adeoque tunc*

*Temporis*

*Temporis Obſervationes inſtituere non eſt Operæ Pretium.*

*Quæ cum ita ſint, Tempus quadrimeſtre, à Sextili priori uſque ad ipſa ferè Acronychia numerandum, utrique Satelliti obſervando erit unice opportunum: Penextimi autem ſoli, inſuper trimeſtre, ab altero poſt Oppoſitionem menſe ad Sextilem poſteriorem.*

*Intra tempora jam definita, octoginta circiter utriuſque ſimul Satellitis fient Eclipſes; penextimi ſc. fere triginta, intimi autem quinquaginta.*

*Has cum non ubivis terrarum, ſed aliæ aliis in locis ſint conſpiciendæ, in ſex Claſſes digeremus.*

1. *In Europâ & Africâ.*
2. *In Aſiâ.*
3. *In Americâ.*
4. *In Europa Africa & Aſia.*
5. *In Europa Africa & America.*
6. *In Aſia Orient. & America Occident.*

} *Eclipſes ſervandas comprehendet.*

*Non opus eſt fortè ut moneamus in Inſulis*

Oceani { *Æthiopici* / *Atlantici* / *Pacifici* } *obſervandam eſſe claſſem* { 4am. / 5am. / 6am. }

*Calculus Eclipſium à nobis exhibendus in ipſo fortaſſe Loco ad quem inſtituitur, plus Horâ integrâ nonnunquam à vero obſervabit, ob variam ſc. in Satellitum motu ἀνωμαλίαν, ab Excentricitate (ut veriſimile eſt) & propriarum ipſis Orbitarum ad Jovis Orbitam Inclinatione oriundam.*

*Alibi autem terrarum multo minus Calculo fidendum, propter incertam inſuper in pleriſque Locis Meridiano-*

*rum Differentiam; quæ tamen ut fiat, Reductio Temporis aliqua utcunque adhibenda est.*

*Longam itaque futuram sæpiuscule Eclipsium harum Expectationem præmonemus, assiduamque interim Attentionem, nec (ob καιρὸν admodum ὀξὺν) unquam fere interruptam, esse continuandam: primum enim, quum Visu assequi possumus Luminis Diminutionem, brevissimâ (præsertim in intimo) interpositâ Morulâ mox insequitur perfecta ejus Extinctio.*

*Molestum autem in observando Tædium, summa* Τηρήσεων ἀκριβεία *abunde compensabit, idemque plurimum minuit, Sociorum mutuas operas tradentium, ubi suppetit Præsentia.*

*Ad momenta temporis accuratissime notanda (quod in hujusmodi Observationibus est Palmarium) perutile erit Horologium Oscillatorium, ab ingeniosissimo & candidissimo Hugenio feliciter excogitatum.*

## APPENDIX.

*LOngitudinis scientiam Nauticam vix unquam de Cœlo expectandam, suprà asseruimus; siqua tamen ejusmodi aliquando futura est, non aliud Fundamentum, quam Lunarium Motuum præcisam Cognitionem, habitura videtur. Horum autem Restitutionem à Parallaxi inchoandam, solertissime monuit Keplerus. Parallaxeως verò indagandæ, & à Lunæ latitudine (cui semper ferè complicatur) distinguendæ, optima (si non sola) Methodus est, quæ, in Regionibus longe dissitis & sub eodem Meridiano positis, Altitudinum Lunæ meridianarum, per singulas Orbitæ Partes simul observatarum serie innititur: inde enim, Polorum Elevatione solum præcognita, certissima innotescit Globi Lunaris à Terrestri Distantia.*

*Proponimus itaque nos Africæ Promontorium Cap. Bonæ Spei, vel in Oceano Atlantico Sanctæ Helenæ Insulam, cum locis in Europâ iis respondentibus, Satellitum Ope, ut docuimus, determinandis, in quibus istiusmodi Observationes commodissimè instituantur.*

Upon the reading of these last *Directions*, Mr. *Rook* the Author of them being dead, I cannot forbear saying something of that excellent Man, which his incomparable *Modesty* would not have permitted me to write, if he had been living. He was indeed a Man of a profound *Judgment*, a vast *Comprehension*, prodigious *Memory*, solid *Experience*. His *Skill* in the *Mathematicks* was reverenc'd, by all the Lovers of those Studies; and his *Perfection* in many other Sorts of Learning deserves no less Admiration. But above all, his *Knowledge* had a right Influence on the Temper of his Mind, which had all the Humility, Goodness, Calmness, Strength, and Sincerity of a sound and unaffected *Philosopher*. This is spoken, not of one who liv'd long ago, in praising of whom it were easie to *feign* and to exceed the *Truth*, where no Man's Memory could confute me: but of one who is lately dead, who has many of his Acquaintance still living, that are able to confirm this *Testimony*, and to join with me, in delivering down his Name to Posterity, with this just Character of his *Virtues*. He died in the year sixty two, shortly after the Establishment of the *Royal Society*, whose *Institution* he had zealously promoted. And it was a deplorable Accident in his Death, that he deceas'd the *very night* which he had for some years expected, wherein to finish his accurate Observations on the *Satellites* of *Jupiter*: however this *Treasure* will not be lost, for the *Society* has refer'd

refer'd it to ſome of the beſt *Aſtronomers* of *Europe*, to bring his Beginnings to Concluſion.

Sect. XXXI. *Their Propoſals and Recommendations.*

To many of theſe *Queries* they have already receiv'd good *Returns*, and *Satisfaction*; and more ſuch *Accounts* are daily expected from all Coaſts. Beſides theſe, there have been ſeveral great and profitable *Attempts*, relating to the Good of Mankind, or the *Engliſh Nation*, propounded to them by many publick Bodies, and private Perſons; which they have again recommended, to be examin'd apart by diverſe of their own *Number*, and by other Men of *Ability* and *Integrity*, who have accepted of their *Recommendations* of this Kind: The principal that I find recorded in their *Regiſters*, are theſe.

They have propounded the compoſing a *Catalogue* of all *Trades*, *Works*, and *Manufactures*, wherein Men are employ'd; in order to the collecting each of their Hiſtories, by taking notice of all the phyſical Receipts or Secrets, the Inſtruments, Tools, and Engines, the manual Operations or Slights, the Cheats and ill Practices, the Goodneſs, Baſeneſs, and different *Value* of Materials, and whatever elſe belongs to the Operations of all *Trades*.

They have recommended the making a *Catalogue* of all the Kinds of *natural Things* to be found in *England*. This is already in a very good Forwardneſs: And for its better completing, many *Expedients* for the preſerving, drying and embalming of all living Creatures have been proſecuted.

They have ſuggeſted the making a perfect *Survey*, *Map*, and *Tables*, of all the fix'd Stars within the *Zodiac*, both viſible to the naked Eye, and diſcoverable by a ſix-foot *Teleſcope*, with a large Aperture; towards

the observing the apparent Places of the Planets, with a *Telescope*, both by Sea and Land. This has been approv'd, and begun, several of the *Fellows* having their Portions of the Heavens allotted to them.

They have recommended the advancing of the *Manufacture of Tapestry:* the improving of *Silk-making:* the propagating of *Saffron:* the melting of *Lead-Oar* with Pit-coal: the making Iron with Sea-coal: the using of the Dust of black Lead instead of Oil in Clocks: the making *Trials* on *English* Earths, to see if they will not yield so fine a Substance as *China*, for the perfecting of the Potter's Art.

They have *propounded* and *undertaken* the comparing of several *Soils* and *Clays*, for the better making of *Bricks* and *Tiles:* the Way of turning *Water* into *Earth*; the observing of the Growth of Pebbles in Waters: the making exact *Experiments* in the large *Florentine* Loadstone: the Consideration of the *Bononian* Stone: the examining of the Nature of *petrifying Springs:* the using an *Umbrella Anchor*, to stay a Sip in a Storm: the Way of finding the *Longitude* of Places by the *Moon:* the Observation of the Tides about *Lundy*, the Southwest of *Ireland*, the *Bermudas*, and diverse parts of *Scotland:* and in other Seas and Rivers, where the ebbing and flowing is found to be irregular.

They have started, and begun to practise, the Propagation of *Potatoes*; the planting of *Verjuice Grapes* in *England*; the chymical Examination of *French* and *English* Wines; the gradual Observation of the Growth of *Plants*, from the first Spot of Life; the increasing of *Timber*, and the planting of Fruit-Trees; which they have done by spreading the Plants into many Parts of the Nation, and by publishing a large

large *Account* of the beſt Ways of their Cultivation.

They have propounded and attempted with great Effect, the making *Experiments* with *Tobacco Oil*; the anatomiſing of all amphibious Creatures, and examining their Lungs; the obſerving the Manner of the *Circulation* of the Blood in Fiſhes; the Ways of tranſporting Fiſh from one Place to another for Breed; the *collecting Obſervations* on the *Plague*; the examining of all the ſeveral Ways to breed *Bees*; the altering the Taſte of the Fleſh of *Animals*, by altering their Food; the Probability of making *Wine* out of *Sugar-Canes*: Which laſt I will ſet down as one Example.

A

# PROPOSAL

## For making WINE.

By Dr. *GODDARD.*

*IT is recommended to the Care of some skilful Planters in* Barbadoes, *to try whether good Wine may not be made out of the Juice of Sugar-canes. That which may induce them to believe this Work to be possible, is this Observation, that the Juice of Wine, when it is dried, does always granulate into Sugar, as appears in Raisins, or dried Grapes: and also that in those Vessels wherein acute, or unfermented Wine is put, the Sides are wont to be cover'd over with a Crust of Sugar. Hence it may be gather'd, that there is so great a Likeness of the Liquor of the Cane, to that of the Vine, that it may probably be brought to serve for the same Uses. If this Attempt shall succeed, the Advantages of it will be very considerable. For the English being the chief Masters of the Sugar Trade, and that falling very much in its Price of late Years, while all other outlandish Productions are risen in their Value; it would be a great Benefit to this Kingdom, as well as to our Western Plantations, if part of our Sugar, which is now in a manner a meer Drug, might be turned into Wine, which is a foreign Commodity, and grows every Day dearer; especially seeing this might be done, by only bruising and pressing the Canes, which would be a far less Labour and Charge, than the Way by which Sugar is now made.*

These are some of the most advantageous *Proposals* they have scattered and encouraged in all Places, where their Interest prevails. In these they have recommended to many distinct and separate *Trials*, those Designs, which some private Men had begun, but could not accomplish, by reason of their *Charge*; or those which they themselves have devis'd, and conceived capable of Success; or even those of which Men have hitherto seem'd to despair. Of these, some are already brought to a hopeful Issue; some are put in Use, and thrive by the Practice of the Publick; and some are discover'd to be feasible, which were only before thought imaginary, and fantastical. This is one of the greatest *Powers* of the true and unwearied *Experimenter*, that he often rescues Things from the Jaws of those dreadful Monsters, *Improbability*, and *Impossibility*. These indeed are two frightful Words to weaker Minds, but by diligent and wise Men, they are generally found to be only the Excuses of *Idleness* and *Ignorance*. For the most part, they lie not in the Things themselves, but in Men's false *Opinions* concerning them; they are rais'd by *Opinions*, but are soon aboliſh'd by *Works*. Many *Things*, that were at first improbable to the Minds of Men, are not so to their Eyes; many that seemed impracticable to their *Thoughts*, are quite otherwise to their *Hands*: many that are too difficult for their naked Hands, may be soon performed by the same Hands, if they are strengthen'd by *Instruments*, and guided by *Method*: many that are unmanageable by a few Hands, and a few Instruments, are easy to the joint Force of a Multitude: many that fail in one *Age*, may succeed by the renew'd Endeavours of *another*. It is not therefore the Conceit or Fancy of Men alone, that is of suffi-

cient Authority to condemn the most unlikely Things for *impossible*; unless they have been often attempted in vain, by many *Eyes*, many *Hands*, many *Instruments*, and many *Ages*.

Sect. XXXII. *The Relations of Things of Nature and Art, they have receiv'd.*

This is the *Assistance* and *Information* they have given to others to provoke them to enquire, and to order and regulate their *Inquisitions*. To these I will add the *Relations* of the Effects of *Nature* and *Art*, which have been communicated to them. These are infinite in Number: And though many of them have not a sufficient Confirmation to raise *Theories*, or *Histories* on their *Infallibility*; yet they bring with them a good Assurance of Likelihood, by the Integrity of the *Relators*; and withal they furnish a judicious *Reader* with admirable Hints to direct his Observations. For I will once more affirm, that as the Minds of Men do often mistake *Falshoods* for *Truths*, though they are ever so circumspect; so they are often drawn by uncertain, and sometimes erroneous *Reports*, to stumble on *Truths* and *Realities*. Of this vast Heap of *Relations*, which is every where scattered in their *Entry Books*, I will only take notice of these occasional *Accounts*.

*Relations* of two new Kinds of *Stars*, observed in the Year sixty six, the one in *Andromeda*, the other in *Cygnus*, in the same Place where they appeared sixty Years since, and have ever since disappear'd; of several Observations of *Cœlestial Bodies* made in *Spain*; of Observations of several of the *Planets* made at *Rome*, and in other Parts, by extraordinary *Glasses*; of the comparative Goodness of *Glasses* us'd in other Countries; of several *Eclipses* observ'd in diverse Parts of the World.

*Relations* of *Parhelii*, and other such Appearances

ſeen in *France*; of the Effects of *Thunder* and *Lightning*; of *Hurricanes*, and *Spouts*; of the Bigneſs, Figure, and Effects of *Hailſtones*; of *Fiſh*, and *Frogs* ſaid to be rain'd; of the raining of Duſt out of the *Air*, and of the Diſtance it has been carried by great *Fires* and *Earthquakes*; of Changes of Weather, and a Way of predicting them; of the Vermination of the *Air*; of the ſuppos'd raining of *Wheat* in *Gloceſterſhire*, which being ſown was found to be nothing but *Ivy Berries*.

*Relations* of a *Spring* in *Lancaſhire*, that will preſently catch Fire on the Approach of a Flame; of *Burning-glaſſes* performing extraordinary Effects; of *Burning-glaſſes* made with Ice; of *Fire-balls* for Fuel; of a more convenient Way of uſing *Wax-Candles*; of the kindling of certain Stones, by their being moiſtened with Water; of uſing ordinary Fuel to the beſt Advantage.

*Relations* of the Times of the riſing and diſappearing of *Springs*; of artificial *Springs*; of the Natures of ſeveral of our *Engliſh Springs*, and of other *oleaginous* and *bituminous Springs*: of the Fitneſs and Unfitneſs of ſome Waters for the making of *Beer* or *Ale*; of brewing Beer with *Ginger* inſtead of *Hops*; of *Tides* and *Currents*; of *petrifying Springs*; of the Water-blaſts of *Tivoly*; of *floating Iſlands* of *Ice*; of the ſhining of *Dew* in a Common of *Lancaſhire*, and elſewhere; of *Divers*, and *Diving*, their Habit, their long holding their Breath, and of other notable *Things* obſerv'd by them.

*Relations* of the Effects of *Earthquakes*, and the moving and ſinking of Earths; of deep *Mines*, and deep *Wells*; of the ſeveral Layers of Earth in a Well at *Amſterdam*; of the ſhining Cliffs in *Scotland*; of the Layers of Earth obſerv'd in diverſe Cliffs; of *Screw-Stones*,

*Stones*, *Lignum Foſſile*, Blocks buried in *Exeter* River, Trees found under Ground in *Cheſhire*, *Lincolnſhire*, and elſewhere; of a Coal-Mine wrought half a Mile from the Shoar, under the Sea; of the fatal Effects of *Damps* on *Miners*, and the Ways of recovering them.

*Relations* of the extraordinary Strength of ſome ſmall *Loadſtones*, taking up above 150 Times their own Weight; of ſeveral *Engliſh Loadſtones*; of the Variation of the *Loadſtone* obſerv'd in two *Eaſt-India* Voyages, and other Places; of the growing of *Pebbles* inclos'd in a Glaſs of Water; of ſeveral excellent *Engliſh* Clays; of Gold found in little Lumps in a Mine in *England*; of the moving Sands in *Norfolk*.

*Relations* about refining *Lead*, and *Tin-Oar*; of hardning *Steel* ſo as to cut *Porphyry* with it, and ſoftning it ſo much, as to make it eaſy to be wrought on; of impregnating *Lead Oar* with *Metal*, after it has been once freed; of *petrify'd Teeth*, and a petrify'd human *Fœtus*; of ſeveral Ways of ſplitting Rocks; of living Muſcles found in the midſt of Rocks at *Leghorn*; of the Way of making *Quickſilver*; of Things obſervable at the Bottom of the Sea; of a ſoft Metal, which hardens after it has taken off the Impreſſion, and the Way of reducing ſuch Impreſſions into as ſmall a Proportion as is deſired.

*Relations* about *Agriculture*; of ordering of *Vines*; of the ſetting and planting of Trees ſeveral Ways; of *Elms* growing from Chips, of new Trees ſprung from rotten Roots; of ſeveral Kinds of Trees, growing one out of another, and in the Place of others; of the beſt Ways of Pruning; of making a Kind of Silk with *Virginia* Graſs; of a Kind of Graſs making ſtronger Ropes than the common Hemp; of a new Way of ordering

dering *Mulberry* Trees in *Virginia*; of a *Locuſt*-Tree *Bow* ſtanding bent ſix Months without loſing its *Spring*; of a way of improving the planting of *Tobacco*.

*Relations* of the Uſefulneſs of changing Seed yearly; of the ſteeping, liming, ſowing it ſeveral Ways; of freeing it from Worms; preſerving it long (as *eighty Years*) of freeing it from *Smut*; of the Cauſes and firſt Signs of *Smut*; of the *Inſtrument* and Way of chopping Straw, for the feeding of Horſes; of Plants growing in *meer Water*; of others growing in *meer Air*; of ſeveral *Indian* Woods; of the growing of the divided Parts of *Beans*, of the growing of chop'd Stalks of *Potatoes*; of ordering *Melons*; of keeping their Seed, and producing extraordinary good ones without *Tranſplanting*.

*Relations* of the Growth, Breeding, Feeding, and Ordering of *Oyſters*; of a *Sturgeon* kept alive in St. *James's-Park*; of the moveable Teeth of *Pikes*; of young *Eels* cut alive out of the old one's Belly; of the tranſporting Fiſh Spawn, and *Carps* alive from one Place to another; of the ſtrange Increaſe of *Carps* ſo tranſported; of *Snake-Stones* and other *Antidotes*; of *Frogs*, *Frog-ſpawn*, *Toads*, *Newts*, *Vipers*, *Snakes*, *Rattle-Snakes*.

*Relations* of ſeveral Kinds of *Poiſons*, as that of *Maccaſſar*, and *Florence*; of *Craw-fiſhes*; of the Generation, Growth, Life, and Transformation of *Ants*; of *Cheeſe Worms* leaping like *Fleas*; of living Worms found in the Entrails of *Fiſhes*; of *Inſects* found in the ſheathing of Ships; of the Generation of *Inſects* out of dead *Cantharides*; of *Inſects* bred in Men's Teeth, Gums, Fleſh, Skin; of great Quantities of *Flies* living in Winter, tho' frozen; of the Ways of ordering *Silk-Worms* in *France*, *Italy*, *Virginia*; and of their not being hurt in *Virginia* by Thunder.

*Rela-*

*Relations* of *Swallows* living after they had been frozen under Water; of *Barnacles* and *Solan Geese*, of a new Way of hatching *Pigeons*; of the Way of hatching *Chickens* in *Egypt*; of *Eggs* proving fruitful, after they had been frozen; of recovering a *tired Horse* with Sheep's Blood.

*Relations* of several Monsters with their Anatomies; of the Measure of a Giant-Child; of Stones found in several Parts of the Body; of an unusual Way of cutting the Stone out of the *Bladder*; of a Woman's voiding the Bones of a *Child* out of her Side, eighteen Years after her having been *with Child*; of grafting Teeth, and making the Teeth of one Man grow in the Mouth of another.

*Relations* of several *Chirurgical* Operations; of renewing the beating of the Heart, by blowing into the *Receptaculum Chyli*; of the *Art* of perfectly restoring Nerves transversly cut, practis'd in *France*; of a *Mummy* found in the Ruins of St. *Paul's*, after it had lain buried above 200 Years; of breaking the Nerve to the *Diaphragm*, and of its Effects; of cutting a *Steatoma* out of a Woman's Breast; of making the Blood *florid* with *Volatile*, and *coagulating* with *Acid* Salts.

*Relations* of sympathetick Cures and Trials; of the Effects of *Tobacco Oil* for casting into Convulsion Fits; of *Moors* killing themselves by holding their Breaths; of walking on the Water by the Help of a Girdle filled with Wind; of *Pendulum* Clocks; of several rare Guns, and Experiments with them; of new *Quadrants* and *Astronomical* Instruments; of Experiments of *Refraction* made by the *French Academy*; of a Way to make use of Eggs in Painting, instead of Oil; of the Island *Hirta* in *Scotland*; of the *whispering Place* at *Glouceſter*; of the *Pike* of *Teneriffe*.

A

# RELATION

OF THE

# *PICO TENERIFFE,*

RECEIV'D FROM

Some conſiderable Merchants and Men worthy of Credit, who went to the Top of it.

" HAving furniſhed our ſelves with a Guide, Ser-
" vants, and Horſes to carry our Wine and
" Proviſions, we ſet out from *Oratava*, a Port Town
" in the Iſland of *Teneriffe*, ſituated on the *North* of
" it, two Miles diſtant from the main Sea. We tra-
" velled from twelve at Night till eight in the Morn-
" ing, by which Time we got to the Top of the firſt
" Mountain towards the *Pico de Terroira*; here, un-
" der a very great and conſpicuous Pine-Tree, we
" brake our Faſt, dined and refreſh'd our ſelves till
" two in the Afternoon; then we proceeded thro'
" much ſandy Way, over many lofty Mountains, but
" naked and bare, aud not cover'd with any Pine-
" Trees, as our firſt Night's Paſſage was. This expo-
" ſed us to exceſſive Heat, till we arrived at the
" Foot of the *Pico*; where we found many huge
" Stones, which ſeem'd to have been fallen down
" from ſome upper Part.

" About

" About six a Clock this Evening, we began to as-
" cend up the *Pico*, but being now a Mile advanced,
" and the Way no more passable for our Horses, we
" quitted and left them with our Servants: In this
" Mile's Ascent some of our Company grew very
" faint and sick, disorder'd by Fluxes, Vomitings, and
" aguish Distempers, our Horses Hair standing upright
" like Bristles; but calling for some of our Wine,
" which was carried in small Barrels on a Horse, we
" found it so wonderfully cold, that we could not
" drink it till we had kindled a Fire to warm it, altho'
" yet the Temper of the Air was very calm and mo-
" derate. But when the Sun was set it began to blow
" with that Violence, and grew so cold, that taking
" up our Lodging under certain great Stones in the
" Rocks, we were constrained to keep great Fires
" before the Mouths of them all Night.

" About four in the Morning we began to mount
" again, and being come about a Mile up, one of the
" Company fail'd, and was able to proceed no far-
" ther. Here began the black Rocks. The rest of
" us pursued our Journey till we came to the *Sugar-*
" *loaf*, where we began to travel again in a white
" Sand, being fore-shod with Shoes whose single Soles
" are made a Finger broader than the upper Leather,
" to encounter this difficult and unstable Passage;
" being ascended as far as the black Rocks, which
" are all flat, and lie like a Pavement, we climbed
" within a Mile of the Top of the *Pico*, and at
" last we gained the *Summit*, where we found no such
" Smoak as appeared a little below, but a continual
" breathing of a hot and sulphurous Vapour, which
" made our Faces extremely sore.

" In this Passage we found no considerable Altera-

" tion of Air, and very little Wind; but being at the
" top, it was ſo impetuous, that we had much ado to
" ſtand againſt it, whilſt we drank the King's Health,
" and fir'd each of us a Piece. Here we alſo brake
" Faſt, but found our Strong-water had quite loſt its
" Force, and was become almoſt inſipid, whilſt our
" Wine was rather more ſpirituous and brisk than
" it was before.

" The Top on which we ſtood, being not above a
" Yard broad, is the Brink of a Pit called the *Caldera*,
" which we judged to be about a Musket-ſhot over,
" and near fourſcore Yards deep, in Shape like a *Cone*,
" within hollow like a Kettle or Cauldron, and all
" over cover'd with ſmall looſe Stones mixt with
" Sulphur and Sand; from amongſt which iſſue diverſe
" Spiracles of Smoak and Heat, when ſtirred with any
" thing puffs and makes a noiſe, and ſo offenſive, that
" we were almoſt ſtifled with the ſudden Emanation
" of Vapours upon the removing of one of theſe
" Stones, which are ſo hot as they are not eaſily to
" be handled. We deſcended not above four or five
" Yards into the *Caldera*, in regard of its ſliding from
" our Feet and the Difficulty. But ſome have ad-
" ventured to the Bottom. Other obſervable Mate-
" rials we diſcover'd none, beſides a clear ſort of *Sul-*
" *phur*, which looks like Salt upon the Stones.

" From this famous *Pico*, we could ken the *Grand*
" *Canaria*, fourteen Leagues diſtant, *Palma* eighteen,
" and *Gomera* ſeven Leagues, which Interval of Sea
" ſeem'd to us not much larger than the River of
" *Thames* about *London*: We diſcerned alſo the *Her-*
" *ro*, being diſtant above twenty Leagues, and ſo to
" the utmoſt Limits of the Sea much farther.

" So ſoon as the Sun appeared, the Shadow of the

" *Pico*

" *Pico* seemed to cover, not only the whole Island,
" and the *Grand Canaries*, but the Sea to the very
" *Horizon*, where the Top of the *Sugar-loaf* or *Pico*
" visibly appeared to turn up and cast its Shade into
" the Air itself, at which we were much surprized:
" But the Sun was not far ascended, when the Clouds
" began to rise so fast, as intercepted our Prospect
" both of the Sea, and the whole Island, excepting
" only the Tops of the subjacent Mountains, which
" seem'd to pierce them through: whether these
" Clouds do ever surmount the *Pico* we cannot say,
" but to such as are far beneath, they sometimes seem
" to hang above it, or rather wrap themselves about
" it, as constantly when the North-west Wind blows;
" this they call the *Cappe*, and is a certain Progno-
" stick of ensuing Storms.

" One of our Company, who made this Journey
" again two Years after, arriving at the Top of the
" *Pico* before Day, and creeping under a great Stone
" to shroud himself from the cold Air (after a little
" Space) found himself all wet, and perceived it to
" come from a perpetual trickling of Water from
" the Rocks above him. Many excellent and very
" exuberant Springs we found issuing from the Tops
" of most of the other Mountains, gushing out in
" great Spouts, almost as far as the huge Pine-Tree
" which we mention'd.

" Having stay'd some time upon the Top, we all
" descended by the sandy Way till we came to the
" Foot of the *Sugar-loaf*, which being steep, even
" to almost a Perpendicular, we soon passed. And here
" we met a Cave of about ten Yards deep, and fifteen
" broad, being in Shape like an Oven or *Cupola*, having
" a Hole at the Top which is near eight Yards over;

" by this we descended by a Rope, which our Ser-
" vants held at the Top, whilst the other end being
" fastned about our Middles, we swing ourselves,
" till being over a Bank of Snow, we slide down,
" and light upon it. We were forced to swing thus
" in the Descent, because in the middle of the Bot-
" tom of this Cave, opposite to the Overture at the
" Top, is a round Pit of Water, resembling a Well,
" the Surface whereof is about a Yard lower than
" the Snow, but as wide as the Mouth at Top, and
" is about six Fathom deep. We suppose this Water
" not a Spring, but dissolv'd Snow blown in, or
" Water trickling through the Rocks.

" About the Sides of the Grot, for some height,
" there is Ice and Icicles hanging down to the Snow.
" But being quickly weary of this excessive cold
" Place, and drawn up again, we continued our
" Descent from the Mountains by the same Passages
" we went up the Day before, and so about five in
" the Evening arrived at *Oratava*, from whence we
" we set forth, our Faces so red and sore, that to
" cool them, we were forced to wash and bath them
" in Whites of Eggs, *&c.*

" The whole Height of the *Pico* in perpendicular
" is vulgarly esteem'd to be two Miles and a half. No
" Trees, Herbs, or Shrubs in all the Passage but Pines,
" and amongst the whiter Sands a kind of Broom,
" being a bushy Plant; and at the side where we lay
" all Night, a kind of *Cordon*, which hath Stems of
" eight Foot high, the Trunk near half a Foot thick,
" every Stem growing in four Squares, and emerging
" from the Ground like Tuffets of Rushes; upon the
" Edges of these Stems grow very small red Buttons
" or Berries, which being squeezed produced a poi-

" sonous

" ſonous Milk, which lighting upon any Part of a " Horſe, or other Beaſt, fetches off the Hair from " the Skin immediately; of the dead Part of this " we made our Fires all Night. This Plant is alſo " univerſally ſpread over the Iſland, and is perhaps a " Kind of *Euphorbium*.

" Of the Iſland *Teneriffe* itſelf, this Account was " given by a judicious and inquiſitive Man, who liv'd " twenty Years in it as a Phyſician and Merchant. " His Opinion is, that the whole Iſland being a Ground " mightily impregnated with Brimſtone, did in for- " mer Times take Fire, and blow up all or near upon " all at the ſame Time, and that many Mountains of " huge Stones calcin'd and burnt, which appear every " where about the Iſland, eſpecially in the South- " weſt Parts of it, were rais'd and heav'd up out of " the Bowels of the Earth, at the Time of that ge- " neral Conflagration; and that the greateſt Quanti- " ty of this Sulphur lying about the Center of the " Iſland, raiſed up the *Pico* to that Height at which " it is now ſeen. And he ſays that any one upon the " Place that ſhall carefully note the Situation and " Manner of theſe calcin'd Rocks how they lye, will " eaſily be of that Mind: For he ſays, that they lye " for three or four Miles almoſt round the Bottom of " the *Pico*, and in ſuch Order one above the other " almoſt to the very *Sugar Loaf* (as 'tis called) as if " the whole Ground ſwelling and riſing up together " by the Aſcenſion of the Brimſtone, the Torrents " and Rivers of it did with a ſudden Eruption rowl " and tumble them down from the reſt of the Rocks, " eſpecially (as was ſaid before) to the South-weſt: " For on that ſide, from the very top of the *Pico* al-

" moſt

" moſt to the Sea-ſhoar, lye huge Heaps of theſe burnt
" Rocks, one under another. And there remain to
" this time the very Tracts of the Rivers of Brim-
" ſtone, as they ran over all this Quarter of the Iſland,
" which hath ſo waſted the Ground beyond Recove-
" ry, that nothing can be made to grow there but
" Broom: But on the North ſide of the *Pico*, few or
" none of theſe Stones appear. And he concluded
" hence, that the *Volcanio* diſcharg'd itſelf chiefly to
" the South-weſt. He adds farther, that Mines of
" ſeveral Metals were broken and blown up at the
" ſame time. Theſe calcin'd Rocks reſembling ſome
" of them Iron-Oar, ſome Silver, and others Copper.
" Particularly at a certain Place in theſe South-weſt
" Parts called the *Azuleios*, being very high Moun-
" tains, where never any *Engliſh* Man but himſelf
" (that ever he heard of) was. There are vaſt Quan-
" tities of a looſe blewiſh Earth intermixt with blue
" Stones, which have on them yellow Ruſt as that
" of Copper and Vitriol: And likewiſe many little
" Springs of vitriolate Waters, where he ſuppoſes was
" a Copper Mine. And he was told by a Bell-founder
" of *Oratava*, that out of two Horſe Loads of this
" Earth, he got as much Gold as made two large
" Rings. And a *Portugueze* told him, who had been
" in the *Weſt-Indies*, that his Opinion was, there were
" as good Mines of Gold and Silver there as the beſt
" in the *Indies*. There are likewiſe hereabout ni-
" trous Waters and Stones covered with a deep Saf-
" fron-colour'd Ruſt, and taſting of Iron. And far-
" ther he mentions a Friend of his, who out of two
" Lumps of Earth or Oar, brought from the top of
" this ſide the Mountain, made two Silver-ſpoons. All
this

" this he confirms from the late Inſtance of the *Palme*
" Iſland eighteen Leagues from *Tenariffa*, where a
" *Volcanio* was fired about twelve Years ſince; the
" Violence whereof made an Earthquake in this Iſland
" ſo great, that he and others ran out of their Honſes,
" fearing they would have fallen upon their Heads.
" They heard the Noiſe of the Torrents of flaming
" Brimſtone like Thunder, and ſaw the Fire as plain
" by Night, for about ſix Weeks together, as a Candle
" in the Room: And ſo much of the Sand and Aſhes,
" brought from thence by the Wind with Clouds,
" fell on his Hat, as fill'd a Sand Box for his Ink-
" horn.

" In ſome Part of this Iſland there grows a crooked
" Shrub which they call *Legnan*, which they bring
" for *England* as a ſweet Wood: There are likewiſe
" Apricots, Peaches, *&c.* in Standard, which bear
" twice a Year, Pear-trees alſo which are as pregnant:
" Almonds of a tender Shell; Palms, Plantains, Orang-
" es and Limons, eſpecially the *Pregnadas* which
" have ſmall ones in their Bellies, from whence they
" are ſo denominated. Alſo they have Sugar-Canes,
" and a little Cotton. *Colloquintida &c.* The Roſes
" blow at *Chriſtmas*. There are good Carnations, and
" very large; but Tulips will not grow or thrive
" there: Sampier cloaths the Rocks in Abundance,
" and a kind of Clover the Ground. Another Graſs
" growing near the Sea, which is of a broader Leaf,
" ſo luſcious and rank, as it will kill a Horſe that eats
" of it, but no other Cattle. Eighty Ears of Wheat
" have been found to ſpring from one Root, but it
" grows not very high. The Corn of this is tranſpa-
" rent and bright like to the pureſt yellow Amber, and

" one

" one Bushel hath produc'd one hundred and thirty
" in a seasonable Year.

" The Canary Birds (which they bring to us in *England*) breed in the *Barancos* or *Gills*, which " the Water hath fretted away in the Mountains, be- " ing Places very cold. There are also Quails, Par- " tridges, larger than ours and exceeding beautiful, " great Wood-pigeons, Turtles at Spring, Crows, " and sometimes from the Coast of *Barbary* appears " the Falcon. Bees are carried into the Mountains, " where they prosper exceedingly.

" They have wild Goats on the Mountains, which " climb to the very top of the *Pico* sometimes: Also " Hogs and Multitudes of Conies.

" Of Fish they have the Cherna, a very large and " excellent Fish, better tasted than any we have in " *England*; the Mero, Dolphin, Shark, Lobsters " without the great Claws, Muscles, Periwinkles, " and the Clacas, which is absolutely the very best " Shell-fish in the World; they grow in the Rocks " five or six under one great Shell, through the top " Holes whereof they peep out with their Nebs, " from whence (the Shells being broken a little more " open with a Stone) they draw them forth. There " is likewise another Fish like an Eel, which hath " six or seven Tails of a Span in Length united to " one Head and Body, which is also as short. Be- " sides these, they have Turtles and Cabridos which " are better than our Trouts.

" The Island is full of Springs of pure Water tast- " ing like Milk. And in *Lalaguna* (where the Wa- " ter is not altogether so limpid and clear (they per- " colate it through a kind of spungy Stone cut in " Form of a Bason.

" The

" The Vines which afford thoſe excellent Wines, " grow all about the Iſland within a Mile of the Sea, " ſuch as are planted farther up are nothing eſteem'd, " neither will they thrive in any of the other Iſlands.

" For the *Guanchios* or antient Inhabitants he " gives this full Account.

" *September* the third, about twelve Years ſince, he " took his Journey from *Guimar* (a Town inhabited " for the moſt Part by ſuch as derive themſelves " from the old *Guanchios*) in the Company of ſome " of them, to view their Caves and the Bodies buried " in them. This was a Favour they ſeldom or never " permit to any (having in great Veneration the Bo- " dies of their Anceſtors, and likewiſe being moſt " extremely againſt any Moleſtation of the Dead) " but he had done ſeveral *eleemoſynary* Cures a- " mongſt them (for they are generally very poor, yet " the pooreſt thinks himſelf too good to marry with " the beſt *Spaniard*) which indeared him to them " exceedingly; otherwiſe it is Death for any Stranger " to viſit theſe Caves or Bodies.

" Theſe Bodies are ſowed up in Goat-skins with " Thongs of the ſame, with very great Curioſity, par- " ticularly in the incomparable Exactneſs and Even- " neſs of the Seams, and the Skins are made very looſe " and fit to the Body. Moſt of theſe Bodies are in- " tire, the Eyes cloſed, Hair on the Head, Ears, Noſe, " Teeth, Lips, Beard, all perfect, only diſcoloured and " a little ſhrivel'd, likewiſe the *Pudenda* of both Sexes; " He ſaw about three or four hundred in ſeveral " Caves, ſome of them are ſtanding, others lie on Beds " of Wood, ſo hardned by an Art they had (which the " *Spaniards* call *Curar*, to cure a piece of Wood) as

" no Iron can pierce or hurt it. He ſays, that one Day
" being hunting a Ferret (which is much in uſe there)
" having a Bell about his Neck, ran after a Coney in-
" to a Hole, where they loſt the Sound of the Bell;
" the Owner being afraid he ſhould loſe his Ferret,
" ſeeking about the Rock and Shrubs, found the
" Mouth of a Cave, and entring in, was ſo affrighted,
" that he cried out. It was at the Sight of one of
" theſe Bodies, very tall and large, lying with his Head
" on a great Stone, his Feet ſupported with a little
" Wall of Stone, the Body reſting on a Bed of Wood
" (as before was mention'd.) The Fellow being now
" a little out of his Fright entred in, and cut off a
" great Piece of the Skin that lay on the Breaſt of this
" Body, which, the Doctor ſays, was more flexible
" and pliant than ever he felt any Kids-leather Glove,
" yet ſo far from being rotten, that the Man uſed it
" for his Flail many Years after.

" Theſe Bodies are very light, as if made up of
" Straw, and in ſome broken Limbs he obſerv'd the
" Nerves and Tendons, and alſo ſome Strings of the
" Veins and Arteries very diſtinctly.

" His great Care was to enquire of theſe People
" what they had amongſt them of Tradition con-
" cerning the Embalming and Preſervation of theſe
" Bodies: from ſome of the eldeſt of them (above
" a hundred and ten Years of Age) he received this
" Account, That they had of old one particular
" Tribe of Men that had this Art amongſt themſelves
" only, and kept it as a thing ſacred, and not to be
" communicated to the Vulgar: Theſe mixt not with
" the reſt of the Inhabitants, nor married out of their
" own Tribe, and were alſo their Prieſts and Miniſters

" of Religion: That upon the Conqueſt of the *Spa-*
" *niards* they were moſt of them deſtroy'd, and the
" Art loſt with them, only they held ſome Traditions
" yet of a few Ingredients, that were made uſe of
" in this Buſineſs. They took Butter of Goats Milk
" (ſome ſaid Hogs Greaſe was mingled with it) which
" they kept in the Skins for this purpoſe; in this they
" boiled certain Herbs; firſt a ſort of wild Laven-
" der, which grows there in great Quantities on the
" Rocks: Secondly, an Herb called Lara, of a very
" gummy and glutinous Conſiſtence, which now
" grows there under the Tops of the Mountains only:
" Thirdly, a kind of Cyclamen or Sow-bread: Fourth-
" ly, wild Sage, growing plentifully in this Iſland:
" Theſe with others bruiſed and boiled in the Butter,
" render'd it a perfect Balſam. This prepared, they
" firſt unbowelled the Corps (and in the poorer ſort,
" to ſave Charges, they took out the Brain behind,
" and theſe poor were alſo ſew'd up in Skins with
" the Hair on, whereas the richer ſort were, as was
" ſaid before, put up in Skins ſo finely and exactly
" dreſſed, as they remain moſt rearly pliant and gen-
" tle to this Day.) After the Body was thus ordered,
" they had in Readineſs a *Lixivium* made of the
" Bark of Pine-trees, with which they waſht the Bo-
" dy, drying it in the Sun in Summer, and in Stoves
" in Winter, this repeating very often. Afterward
" they began their Unction with the Balſam, both
" without and within, drying it again as before. This
" they continued till the Balſam had penetrated in-
" to the whole Habit, and the Muſcles in all parts ap-
" peared through the contracted Skin, and the Body
" became exceeding light: Then they ſew'd them

" up in the Goat-skins, as was mention'd already.
" He was told by these antient People, that they
" have above twenty Caves of their Kings and great
" Persons, with their whole Families, yet unknown
" to any but themselves, and which they will never
" discover. Lastly, he says, that Bodies are found
" in the Caves of the *Grand Canaria* in Sacks, and
" quite consumed, not as these in *Teneriffa*. Thus far
" of the Bodies and embalming.

" Anciently when they had no Knowledge of Iron,
" they made their Lances of Wood hardned as be-
" fore, some of which the Doctor hath seen. He hath
" also seen Earthen-pots so hard, that they cannot be
" broken; of these some are found in the Caves and
" old *Bavances*, and used by the poorer People that
" find them, to boil Meat in. Likewise they had *Cu-*
" *ror* Stone itself, that is to say, a Kind of Slate called
" now *Tobona*, which they first formed to an Edge or
" Point as they had Occasion to use it, either as Knives
" or Lancets to let Blood withal.

" Their Food is Barley roasted, and then ground
" with little Mills, which they made of Stone, and
" mixt with Milk and Honey: This they still feed
" on, and carry it on their Backs in Goat-skins.

" To this Day they drink no Wine, nor care for
" Flesh. They are generally very lean, tall, active
" and full of Courage.

" He himself hath seen them leap from Rock to
" Rock, from a very prodigious Height, till they
" came to the Bottom, sometimes making ten Fathom
" deep at one leap.

" The manner is thus:

" First they *teretate* their Lance (which is about

" the

" the Bigneſs of a half Pike) that is, they poiſe it " in their Hand, then they aim the Point of it at any " Piece of a Rock, upon which they intend to light " (ſometimes not half a Foot broad.) At their going " off they clap their Feet cloſe to the Lance, and ſo " carry their Bodies in the Air. The Point of the " Lance firſt comes to the Place, which breaks the " Force of their Fall; then they ſlide gently down " by the Staff, and pitch with their Feet upon the " very place they firſt deſigned, and from Rock to " Rock till they come to the Bottom. Their " Novices ſometimes break their Necks in learn- " ing.

" He added ſeveral Stories to this Effect of their " great Activity in leaping down Rocks and Cliffs. " And how twenty eight of them made an Eſcape " from the Battlements of an extraordinary high " Caſtle in the Iſland, when the Governor thought " he had made ſure of them.

" He told alſo (and the ſame was ſeriouſly con- " firm'd by a *Spaniard*, and another *Canary* Mer- " chant then in the Company.) That they whiſtle ſo " loud as to be heard five Miles off: And that to be " in the ſame Room with them when they whiſtle, " were enough to indanger breaking the *Tympanum* " of the Ear, and added; that he (being in Compa- " ny of one that whiſtled his loudeſt) could not hear " perfectly for fifteen Days after, the Noiſe was ſo " great.

" He affirms alſo, That they throw Stones with a " Force almoſt as great as that of a Bullet, and " now uſe Stones in all their Fights as they did " anciently.

When my *Reader* ſhall behold this large Number of *Relations*; perhaps he will think, that too many of them ſeem to be incredible Stories, and that if the *Royal Society* ſhall much buſy themſelves, about ſuch wonderful and uncertain *Events*, they will fall into that Miſtake, of which I have already accus'd ſome of the *Antients*, of framing *Romances*, inſtead of ſolid *Hiſtories* of Nature. But here, though I ſhall firſt confirm what I ſaid before, that it is an unprofitable, and unſound Way of *Natural Philoſophy*, to regard nothing elſe, but the prodigious and extraordinary *Cauſes* and *Effects*; yet I will alſo add, that it is not an unfit Employment for the moſt judicious *Experimenter*, to examine and record the moſt unuſual and monſtrous Forces, and Motions of *Matter*. It is certain that many things, which now ſeem *miraculous*, would not be ſo, if once we come to be fully acquainted with their *Compoſitions* and *Operations*. And it is alſo as true, that there are many *Qualities*, and *Figures*, and *Powers* of things, that break the common Laws, and tranſgreſs the ſtanding Rules of *Nature*. It is not therefore an Extravagance, to obſerve ſuch *Productions*, as are indeed *admirable* in themſelves, if at the ſame time we do not ſtrive to make thoſe appear to be *admirable*, that are groundleſs and falſe. In this there is a near Reſemblance between *Natural* and *Civil Hiſtory*. In the *Civil*, that way of *Romance* is to be exploded, which heightens all the Characters and Actions of Men, beyond all Shadow of *Probability*; yet this does not hinder, but the great and eminent *Virtues* of extraordinary Men of all Ages, may be related and propos'd to our Example. The ſame is to be affirm'd of *Natural Hiſtory*. To make that only to conſiſt of ſtrange and delightful Tales, is to render it nothing

nothing else but *vain* and *ridiculous Knight-Errantry*. Yet we may avoid that Extreme, and still leave room to consider the singular and irregular *Effects*, and to imitate the unexpected and monstrous *Excesses*, which *Nature* does sometimes practise in her *Works*. The first may be only compar'd to the Fables of *Amadis*, and the *Seven Champions*; the other to the real *Histories* of *Alexander*, *Hannibal*, *Scipio*, or *Cæsar*: in which though many of their Actions may at first surprize us; yet there is nothing that exceeds the *Truth* of *Life*, and that may not serve for our *Instruction*, or *Imitation*.

Sect. XXXIII. *The Experiments they have try'd.*

If this Way of general receiving all credible Accounts of *Natural*, and *Artificial Productions*, shall seem expos'd to overmuch Hazard and Uncertainty: that Danger is remov'd by the *Royal Society*'s reducing such Matters of Hear-say and Information, into real and impartial *Trials*, perform'd by their own *Hands*: Of the Exactness, Variation and accurate Repetition of their *Experiments*, I have already discours'd: I will now go on to lay down in short Compass those Parts of the visible World, about which they have chiefly bestow'd their *Pains*.

*Of Fire.*

The first Kind that I shall mention, is of *Experiments* about *Fire*, and *Flame*, of these many were made in order to the Examination of a *Theory* propounded to them, that there is no such thing, as an *elementary Fire* of the *Peripatetics*; nor *fiery Atoms* of the *Epicureans*: but that *Fire* is only the Act of the Dissolution of heated *sulphureous Bodies*, by the *Air* as a *Menstruum*, much after the same manner as *Aqua Fortis*, or other sharp *Menstruums* do work on dissoluble

luble Bodies, as *Iron, Tin, Copper:* that Heat and Light are two inſeparable Effects of this Diſſolution, as Heat and Ebullition are of thoſe Diſſolutions of *Tin*, and *Copper:* that *Flame* is a Diſſolution of *Smoak*, which conſiſts of combuſtible Particles, carried upward by the Heat of rarified *Air:* and that *Aſhes* are a Part of the *Body* not diſſoluble by the *Air*.

Of this Sort, they have made *Experiments*, to find the laſting of the burning of a Candle, Lamp, or Coals, in a cubic Foot of common, rarified, and *condens'd Air:* to exhibit the ſudden Extinction of Candles, Lamps, and lighted Coals, when they are put into *ſatiated Air:* to ſhew the ſpeedy Extinction of kindled Charcoals, by blowing on them with Bellows, that *Air* which had before been ſatiated with burning: to ſhew that the greateſt and moſt laſting Heat, without a Supply of freſh *Air*, is unable to burn Wood, Sulphur, and moſt other combuſtible Matters: to find the comparative Heat of all Kinds of *Fires*, and *Flames* of ſeveral Materials, as of Sulphur, Camphire, Spirit of Wine, Oyl, Wood, Coal, Seacoal, Iron: to find at what Degree of Heat, Lead, Tin, Silver, Braſs, Copper, Gold will melt.

*Experiments* of the Tranſparency, and Refractedneſs of *Flames:* of diſcerning the Strength of ſeveral Kinds of Gunpowder, *Pulvis Fulminans*, *Aurum Fulminans:* of Gunpowder in the exhauſting Engine: of bending Springs by the Help of Gunpowder: of melting Copper immediately, by the Help of a Fluxpowder: of the recoyling of Guns.

*Experiments* of Candles, and Coals, extinguiſh'd by the Damps of a deep Well: of the burning of Lamps under Water: of burning Spirit of Wine and Camphire together, and the Diverſity of their *Flames:* of reducing

reducing Copper to a very combuſtible Subſtance: of heating the *Air*, by blowing it through a red-hot earthen *Pipe*, ſo as to burn Wood: of the Brightneſs of the *Flame* of *Niter* and *Sulphur*: of the burning and flaming of Tin Filings by the Help of *Niter*: of kindling Bodies, in common rarified and condens'd *Air*, by the Help of a *Burning-glaſs*: of the comparative Heat caſt by a *Burning-glaſs*, in the Morning, and at Noon: of burning with a *Lens* made of Ice: of calcining *Antimony* in the Sun with Loſs: to find whether *Aurum Fulminans* or *Putris Fulminans* do flame upon *Exploſion*: of hatching *Eggs* with a Lamp Furnace.

Their ſecond Sort of *Experiments* is of thoſe that have been made in order to find out the Nature, Properties, and uſes of *Air*: Such as theſe. *Of Air.*

*Experiments* for determining the Height of the *Atmoſphere*, for finding the Preſſure of the *Atmoſphere*: on the Tops of Mountains, on the Surface of the Earth, and at the Bottoms of very deep Pits and Mines, by the Help of *Quick-ſilver*, and other Contrivances: for finding the Preſſure of the *Atmoſphere*, both in the ſame Place, and Places very far remov'd.

*Experiments* to determine the poſſible Bounds of Expanſion and Condenſation of the *Air*, by Heat and Cold, by exhauſting and compreſſing: to determine the Strength of *Air* under the ſeveral Degrees of *Rarefaction* and *Condenſation*: of the Force of condens'd *Air* in Wind-Guns, to ſtate the comparative Gravity of the *Air* to other fluid and ſolid Bodies: to diſcover the refractive Power of the *Air*, under the ſeveral Degrees of *Rarefaction* and *Condenſation*: to manifeſt the inflective Veins of the *Air*: to produce a Kind of Opacity of the *Air*: of the falling of Smoak in rari-

fied *Air*: to make *Glass Bubbles* swim in *Air* very much condens'd: of *Glass-balls* rising in a heavy or condens'd *Air*, and falling in a lighter and more rarified.

*Experiments* of the Propagation of Sounds through common rarified and condens'd *Air*: of the Congruity or Incongruity of *Air*, and its Capacity to penetrate some Bodies, and not others: of generating *Air* by corrosive *Menstruums* out of fermenting Liquors, out of Water and other Liquors, by Heat and by Exhaustion: of the returning of such *Air* into the *Water* again: of the vanishing of *Air* into *Water* exhausted of *Air*: of the maintaining and increasing a *Fire* by such *Airs*: of the Fitness and Unfitness of such *Air* for Respiration: of the Use of *Air* in breathing.

*Experiments* of keeping Creatures many Hours alive, by blowing into the *Lungs* with Bellows, after that all the *Thorax* and *Abdomen* were open'd and cut away, and all the Entrails, save the *Heart* and *Lungs*, remov'd: of reviving *Chickens*, after they have been strangled, by blowing into their *Lungs*: to try how long a Man can live, by exspiring and inspiring again the same *Air*: to try whether the *Air* so respired, might not by several Means be purified or renew'd: to prove that it is not the Heat nor the Cold of this respired *Air*, that choaks.

*Experiments* of the respiring of *Animals* in *Air* much rarified, and the fatal Effects: of the long Continuance of several *Animals* very well in *Air* as much condens'd, as it will be under Water, at two hundred Fathoms deep, that is about eight times: of the Quantity of fresh *Air* requisite for the Life of a respiring *Animal*, for a certain Space of Time: of making *Air* unfit for Respiration, by satiating it, by suffering Can-

dles or Coals to burn in it, till they extinguish themselves.

*Experiments* of including living *Animals*, and kindled Coals, and Candles, in a large Glass, to observe which of them will be first extinguish'd: of a Man's living half an Hour, without any Inconvenience, in a *Leaden Bell*, at diverse Fathoms under Water: of the Quantity of *Air* respir'd at once by a Man: of the Strength a Man has to raise Weights by his Breath.

*Experiments* of the swelling of an Arm put into the rarifying Engine, by taking off the Pressure of the *Ambient Air*: of the swelling of Vipers and Frogs, upon taking off the Pressure of the *Ambient Air*: of the Life, and free Motion of Fishes in Water, under the Pressure of *Air* eight Times condens'd: of Insects not being able to move in exhausted *Air*: of the Resistance of *Air* to Bodies mov'd through it: of the not growing of Seeds for want of *Air*: of the growing of Plants hung in the *Air*, and of the Decrease of their Weight: of the living of a Cameleon, Snakes, Toads, and diverse Insects, in a free *Air*, without Food: of conveying *Air* under Water to any Depth: of condensing *Air* by *Water*, and by the Expansion of freezing *Water*: of the swelling of *Lungs* in the rarifying Engine: of the Velocity and Strength of several *Winds*.

The third Kind, are those which have been made about the Substance and Properties of *Water*: Such are, *Of Water.*

*Experiments* about the comparative Gravity of *salt Water* and *fresh*, and of several *Medicinal Springs* found in this Nation: of the different Weight of the *Sea-water*, in several Climates, and at several Seasons:

of the Weight of *Diſtill'd-water*, *Snow-water*, *May-dew*, *Rain-water*, *Spring-water*: of augmenting the Weight of *Liquor*, by diſſolving *Salts*: of the greater Thickneſs of ſuch *Water* at Bottom than at the Top: of weighing aſcending and deſcending Bodies in *Water*; of the Preſſure of the *Water* at ſeveral Depths under its Surface.

*Experiments* of the Heat and Cold of the *Water*, at ſeveral Depths of the *Sea*: of propagating Sounds through the *Water*: of ſounding the Depth of the Sea without a Line: of fetching up *Water* from the Bottom of the Sea, of fetching up Earth, Sand, Plants, from the Bottom of the Sea.

*Experiments* of the Reſiſtance of *Water* to Bodies mov'd on its Surface, of ſeveral Figures, and by ſeveral Degrees of Force: of the Reſiſtance of *Water* to Bodies mov'd through its Subſtance, aſcending and deſcending: of the Expanſion and Condenſation of *Water* by Heat and Cold: of the Condenſation of *Water* by ſeveral Ways of Preſſure: of converting *Water* into a vaporous *Air*, laſting ſome time in that Form: the *Torricellian Experiment* tried with *Water* in a *Glaſs-Cane* thirty ſix and forty Foot high, in a leaden *Tube* alſo with a Glaſs at the Top: the ſame tried with Oil, and other Liquors.

*Experiments* of the riſing of *Water* in ſmall *Tubes*, and many others about its Congruity: of Filtration, or of the riſing of *Water* to a great Height in Sand, *&c.* of the ſwimming of Fiſhes: of *Water's* being able to penetrate through thoſe Pores, where *Air* will not: of opening Bellows at a Depth under *Water*, and blowing up Bladders, to find the Preſſure of the *Water*: of *Water* not ſubſiding in a high Glaſs-Cane upon removing the ambient Preſſure, after it had been well exhauſted:

hauſted of the *Air-bubbles* that lurk'd in it: of forcing *Water* out of a Veſſel by its own Vapours.

*Experiments* of the different Weight and Refraction of warm *Water* and cold; of the paſſing of *Water* through the Coats of a Man's Stomach; of the living of Fiſh in *Water*, the *Air* being exhauſted; of cloſing up a Fiſh in a Glaſs of *Water*; of the dying of Fiſhes in *Water*, upon taking off the Preſſure of the *Air*, in the rarifying Engine; of *Hydroſtaticks*, and making a Body ſink by pouring more *Water* upon it; of raiſing *Water* above its Standard by ſucking; of the ſubſiding of *Water* in the Stem, upon putting the Bolt-head into warm *Water*; of the ſhrinking of *Water* upon cooling.

The fourth Kind are about *Mines, Metals, Oars, Stones, &c.* Such as *Of Metals and Stones.*

*Experiments* of *Coppelling* made at the Tower; of diſſolving many Salts in one Liquor; of the *Oculus Mundi*; of *Ruſma*; of the Tenacity of ſeveral *Metals* examin'd by Weights; of the Rarefaction and Condenſation of Glaſs; of the volatiſing *Salt of Tartar*, with burnt Alom, with Vinegar and Spirit of Wine; on the *Bononian Stone*; on *Diamonds*, of their ſhining by rubbing; on *Copper-Oar*; of the Diſtillation of *Coal*; of refining ſeveral Kinds of *Lead-Oar*; of extracting a much greater Quantity of *Silver* out of that Oar, than is commonly done; of ſeveral Ways of reducing *Letharges* into *Lead*; of changing *Gold* into *Silver*.

*Experiments Magnetical*, of the beſt Form of capping *Loadſtones*; of the beſt Forms of *Needles*, of ſeveral Lengths and Bigneſſes: of various Ways of touching *Needles* on the *Loadſtone*; of making the ſame

ſame Pole of the *Loadſtone* both attract and chaſe the ſame End of the *Needle*, without touching it; to find the Variation of the *Loadſtone* here at *London*.

*Experiments* with the dipping *Needle*; of the extraordinary Strength in Proportion to its Bulk of a ſmall *Loadſtone*; to meaſure the Strength of the *Magnetical* attractive Power, at ſeveral Diſtances from the *Stone*: to examine the Force of the attractive Power, through ſeveral *Mediums*, as Water, Air, Wood, Lead, and Stone; to divert the attractive Power, by interpoſing Iron; to find the directive Virtue of the *Loadſtone* under Water.

*Experiments* to manifeſt, by the Help of Steel-duſt, the Lines of the directive Virtue of the *Loadſtone* to be oval, in a contrary Poſition to what *Des Cartes*'s *Theory* makes them; to manifeſt thoſe Lines of Direction by the Help of *Needles*; to diſcover thoſe Lines of Direction, when the Influence of many *Loadſtones* is compounded; to find what thoſe Lines are incompaſſing a *Sphærical Loadſtone*, what about a Square, and what about a regular Figure; to bore through the *Axis* of a *Loadſtone*, and fill it up with a *Cylindrical Steel*: *Experiments* on *Loadſtones* having many Poles, and yet the *Stones* ſeeming uniform.

*Of Vegetables.* The fifth Kind is of the Growth of *Vegetables* in ſeveral Kinds of Water; as *River-water*, *Rain-Water*, *Diſtill'd Water*, *May-Dew*; of hindring the Growth of Seed-Corn in the Earth, by extracting the Air, and furthering their Growth, by admitting it; of ſteeping Seeds of ſeveral Kinds; of inverting the Poſitions of *Roots* and *Plants* ſet in the Ground, to find whether there are Valves in the Pores of the Wood, that only open one Way; of the Decreaſe of the Weight

of

of *Plants* growing in Air; of *Lignum Foſſile*; of the growing of ſome Branches of *Roſemary*, by only ſprinkling the leaves with Water; of *Camphire Wood*; of Wood brought from the *Canaries*; of a ſtinking Wood brought out of the *Eaſt-Indies*; of the Re-union of the *Bark* of *Trees* after it had been ſeparated from the *Body*.

The ſixth are *Experiments Medicinal* and *Anatomical*; as of cutting out the Spleen of a Dog; of the Effects of Vipers biting Dogs; of a *Camæleon*, and its Diſſection; of preſerving *Animals* in Spirit of Wine, Oil of Turpentine, and other Liquors; of injecting various Liquors, and other Subſtances into the Veins of ſeveral Creatures. *Medicinal and Anatomical.*

*Experiments* of deſtroying *Mites* by ſeveral Fumes; of the equivocal Generation of *Inſects*; of feeding a *Carp* in the Air; of making Inſects with Cheeſe, and Sack; of killing Water-Newts, Toads, and Sloworms with ſeveral Salts; of killing Frogs, by touching their Skin with Vinegar, Pitch, or Mercury; of a Spider's not being inchanted by a Circle of *Unicorn's Horn*, or *Iriſh Earth*, laid round about it.

*Experiments* with a poiſon'd *Indian Dagger* on ſeveral *Animals*; with the *Maccaſſar* Poiſon; with *Florentine* Poiſon, and ſeveral *Antidotes* againſt it; of making Fleſh grow on, after it has been once cut off; of the grafting a *Spur* on the Head of a *Cock*, and its growing; of the living of Creatures by factitious Air; of the reviving of *Animals* ſtrangled, by blowing into their *Lungs*; of Fleſh not breeding Worms, when ſecur'd from Fly-blowing; of the Suffocation of *Animals* upon piercing the *Thorax*; of hatching Silk-Worm's Eggs in rarified Air; of tranſfuſing the Blood of one *Animal* into another.

The

*Of ſenſible Qualities.*

The ſeventh Sort are about thoſe which are call'd *ſenſible Qualities*; as of Freezing; of Cold, and Heat; of freezing Water freed from Air; of the Time and Manner of the Contraction in freezing luke-warm Water; of the Temperature of ſeveral Places, by ſeal'd *Thermometers*; as of ſeveral Countries; of the Bottoms of deep Mines, Wells, Vaults, on the Tops of Hills, at the Bottom of the Sea.

*Experiments* on the Contraction of Oil of *Vitriol*; and diverſe other Oils by *freezing*; of *freezing* bitter Tinctures; of *freezing* ſeveral ting'd Liquors, and driving all the Tincture inward to the Center; of ſhewing Ice to be capable of various Degrees of Cold, greater than is requiſite to keep it Ice; of producing Cold by the Diſſolution of ſeveral Salts; of *freezing* Water without *Blebs*; of a membranous Subſtance ſeparable from the Blood by *freezing*; of a *Thermometer* in rarified and condens'd Air; of very eaſy *freezing* of Oil of Aniſeeds; of making a Standard of Cold by *freezing* diſtill'd Water.

*Of other Qualities.*

The eighth are of *Rarity*, *Denſity*, *Gravity*, *Preſſure*, *Levity*, *Fluidity*, *Firmneſs*, *Congruity*, &c. as of the Nature of *Gravity*; of the Cohæſion of two flat Marbles; of compreſſing the Air with *Mercury* to find its Spring; of the Weights of Bodies, ſolid and fluid; of Rarefaction and Condenſation by the Help of *Mercury*; of the Tenacity of ſeveral Bodies; of the turning of two very fluid Liquors into one ſolid Maſs, by mingling them together.

*Experiments* for examining, whether the Gravity of Bodies alter, according as they are carried a good Way above or below the Surface of the Earth; of the

ſtanding of *Mercury* well exhauſted, many Inches, nay many Feet, above its uſual ſtanding; of a *Wheel-Barometer*, of the Expanſion, and Contraction of Glaſs and Metals by Heat and Cold; of Spirit of Wine, and ſeveral ting'd Liquors, by the Help of a Glaſs Tube; the Examination of *Monſieur Paſchal's* Experiment by many others.

The ninth are *Experiments* of *Light*, *Sound*, *Colours*, *Taſte*, *Smell*; as of two tranſparent Liquors producing an opacous one: of Echoes and reflected *Sounds*; of muſical *Sounds* and *Harmonies*; of Colours; of the greater Refraction of Water than of Ice; of Refraction in a new Engine; of the Refraction of Glaſs of various Shapes under Water; of deſtroying the ſhining of Fiſh by Oil of *Vitriol*; of making a great Light by rubbing two Chryſtals hard one againſt the other; of making a *deaf* and *dumb* Man to ſpeak. *Of Light, Sound, &c.*

The tenth are *Experiments* of *Motion:* as of Glaſs Drops ſeveral Ways order'd and broken; of the Velocity of the Deſcent of ſeveral Bodies of diverſe Faſhions through ſeveral Liquors; of determining the Velocity of Bodies falling through the Air, tried by many Ways; of the *ſwift Motion* of Sounds; of the irregular *Motion* of the Oil of Turpentine on Spirit of Wine; of the Strength of falling Bodies, according to the ſeveral Heights, from which they fall; of proportioning the Shapes of Bodies, ſo as to make them fall together in the ſame Time through differing *Mediums*. *Of Motion.*

*Experiments* of the Swiftneſs of a Bullet ſhot with extraordinary Powder; of the beſt Figure of the

Weight of a *Pendulum* for *Motion*; of the *Motion* of pendulous Bodies of various Figures; to determine the Length of *Pendulums*, to find the Velocity of the Vibrations of a ſounding String; to find the Velocity of *Motion*, propagated by a very long extended Wire; for explaining the Inflection of a ſtrait Motion into a circular, by a ſupervening attractive Power towards the Center, in order to the explaining of the *Motion* of the Planets.

*Experiments* of the circular and complicated *Motion* of *Pendulums*, to explain the *Hypotheſis* of the Moon's moving about the Earth; of comparing the *Motions* of a circular *Pendulum*, with the *Motion* of a ſtrait one; of the Propagation of *Motion* from one Body to another; of the Reflection of *Motion*; of the vibrating *Motion* of *Quickſilver* in a crooked Pipe, imitating the *Motion* of a *Pendulum*; of communicating of the Strength of Powder for the bending of Springs; and thereby for making artificial Muſcles, to command what Strength we deſire.

*Chymical and Mechanical.*

The eleventh are *Experiments Chymical, Mechanical, Optical*; as of reducing the Fleſh of Animals into a Liquor like Blood, by diſſolving it in a certain *Menſtruum*; of a great Facility of raiſing Water in Pipes of a large Bore; of brewing Beer with Bread, Barley, Oats, Wheat, and without melting; of precipitating Tartar out of *Wine* by ſeveral Expedients; of a *chymical* Extraction of a volatile Spirit, and Salt out of Spunges; of examining *Aurum fulminans* after Exploſion; of the Diſſolution of *Manna* in Water, and of a chryſtalliſing it again out of it, by Evaporation.

*Expe-*

*Experiments* of *volatiſing* Salt of *Tartar* many Ways; of examining the *mucilaginous* Matter call'd *Star-ſhoot*; of examining our *Engliſh Teleſcopes*, and *Microſcopes*, and comparing them with ſuch as have been made at *Rome*; of making a volatile Salt with Oil of *Turpentine*, and Sea-ſalt; of the Quantity of Spirits in *Cyder*; of the Strength of ſeveral Springs; of examining a Pump made with Bellows; of dying Silk with ſeveral *Jamaica* Woods; of finding the Strength of Wood of ſeveral Kinds, for bearing; of finding the Flexibility of various Woods, and determining the utmoſt Extent of their yielding and bending.

*Experiments* about the Gravity of Bodies made on the Top of St. *Paul*'s Steeple, *Weſtminſter Abby*, and ſeveral other high Places; and in a Well of ſeventy Fathoms Depth; examined about the *Virgula Divina*, wherein the common Aſſertions were found falſe; of the various Refractions of ſeveral Liquors, in a new refractive Engine of common Oil of *Tobacco*, made by Diſtillation in a Glaſs Retort; of making the Object Glaſs of a *Microſcope* to bear as large an Aperture as is deſir'd.

Of this their Way of Experimenting I will here produce theſe Examples.

# EXPERIMENTS

## Of the Weight of Bodies increaſed in the FIRE:

*Made at the* Tower, *and the Account brought in by my Lord* BROUNCKER.

1. *Copper and Lead.*

| | *d.* | *gr.* |
|---|---|---|
| THE *Copel weighed* | 10 | 8 $\frac{1}{32}$ |
| *Lead* — — — | 4 | 9 |
| *Copper* — — — | 0 | 6 |
| *Into the Fire all three* — | 14 | 23 $\frac{1}{32}$ |
| *Out of the Fire* — — | 15 | 4 $\frac{8}{32}$ |
| *Gained* — | 0 | 5 $\frac{7}{32}$ |

*Beſides what the Copel loſt in Weight, ſuppoſed to be about three Grains.*

2. *Copper and Lead.*

| | *d.* | *gr.* |
|---|---|---|
| *Copel* — — — | 10 | 2 |
| *Lead* — — — | 4 | 9 $\frac{3}{4}$ |
| *Copper* — — — | 0 | 6 |
| *Into the Fire all three* — | 14 | 17 $\frac{3}{4}$ |
| *Out of the Fire* — — | 15 | 1 $\frac{12}{32}$ |
| *Gained* — | 0 | 7 $\frac{27}{32}$ |

3. *Lead*

3. *Lead alone.*

| | *d.* | *gr.* |
|---|---|---|
| *Copel* — — — | 10 | 3 $\frac{22}{32}$ |
| *Lead* — — | 4 | 9 |
| *Into the Fire both* — | 14 | 12 $\frac{22}{32}$ |
| *Out of the Fire* — — | 14 | 3 $\frac{12}{32}$ |
| *Gained* — | 0 | 10 $\frac{22}{32}$ |

4. *Lead alone.*

| | *d.* | *gr.* |
|---|---|---|
| *Copel* — — — | 10 | 10 $\frac{7}{8}$ |
| *Lead* — — | 4 | 9 |
| *Into the Fire both* — | 14 | 19 $\frac{7}{8}$ |
| *Out of the Fire* — — | 15 | 1 $\frac{5}{64}$ |
| *Gained* — | 0 | 5 $\frac{13}{64}$ |

5. *Copel alone.*

| | *d.* | *gr.* |
|---|---|---|
| *Into the Fire* — — | 10 | 5 |
| *Out of the Fire* — — | 10 | 1 $\frac{3}{8}$ |
| *Loſt* — | 0 | 3 $\frac{5}{8}$ |

6. *Copel alone.*

| | *d.* | *gr.* |
|---|---|---|
| *Into the Fire* — | 10 *wanting* | 7 $\frac{3}{4}$ |
| *Out of the Fire* — | 10 *wanting* | 9 |
| *Loſt* — | 0 — | 1 $\frac{1}{4}$ |

EXPE-

# EXPERIMENTS

Of a Stone called

## *OCULUS MUNDI,*

Made by Dr. GODDARD.

A *Small Stone of the Kind, called by ſome Authors* Oculus Mundi, *being dry and cloudy, weighed* —— —— 5 *gr.* $\frac{200}{210}$

*The ſame being put under Water, for a Night and ſomewhat more, became tranſparent, and the Superficies being wiped dry, weighed* —— —— 6 *gr.* $\frac{1}{210}$

*The Difference between theſe two Weights* — 0. $\frac{10}{210}$

*The ſame Stone kept out of Water one Day, and becoming cloudy again, weighed* —— —— 5. $\frac{221}{210}$

*which was more than the firſt Weight* —— 0. $\frac{11}{210}$

*The ſame being kept dry two Days longer, weighed* —— —— —— —— 5. $\frac{209}{210}$

*which was leſs than at firſt* —— —— —— 0. $\frac{1}{210}$

*Being put under Water for a Night, and becoming again tranſparent, and wiped dry, the Weight was* 6. $\frac{3}{210}$ *the ſame with the firſt, after putting in Water, and more than the laſt Weight, after keeping of it dry* —— 0. $\frac{12}{210}$

*Being kept dry ſome time longer, it did not grow ſenſibly lighter.*

*Another Stone, of the ſame Kind, being variegated with milky, white, and grey, like ſome Sort of Agates, while it lay under Water, was always invironed with little Bubbles, ſuch as appear in Water before boiling, next the Sides of the Veſſel.*

*There*

*There were also some of the like Bubbles on the Surface of the Water just over it; as if either some Exhalations came out of it, or that it did excite some Fermentation in the Parts of the Water contiguous to it.*

*There was little sensible Difference of Transparency in this Stone, before the putting under Water, and after: To be sure the milky white Parts continued as before, but more different in Weight than in the former. For whereas, before the putting into the Water, the Weight was —— 18 gr. $\frac{97}{128}$ after it had lain in about twenty-four Hours, the Weight was 20 gr. $\frac{225}{128}$; so the Difference was —— 1 gr. $\frac{128}{128}$.*

*The same Stone was infused in the Water scalding hot, and so continued for a while after it was cold, but got no more Weight, than upon infusing in the cold; neither was their any sensible Difference in the Weight both times.*

An

# An Account of a Dog dissected, By Mr. *HOOK*.

*IN Prosecution of some Inquiries into the Nature of Respiration in several Animals; a Dog was dissected, and by means of a Pair of Bellows, and a certain Pipe thrust into the Wind-pipe of the Creature, the Heart continued beating for a very long while after all the Thorox and Belly had been open'd, nay after the* Diaphragm *had been in great Part cut away, and the* Pericardium *remov'd from the Heart. And from several Trials made, it seem'd very probable, that this Motion might have been continued, as long almost as there was any Blood left within the Vessels of the Dog; for the Motion of the Heart seem'd very little chang'd, after above an Hour's time from the first displaying the* Thorax; *though we found, that upon removing the Bellows, the Lungs would presently grow flaccid, and the Heart begin to have convulsive Motions; but upon removing the Motion of the Bellows, the Heart recover'd its former Motion, and the Convulsions ceased. Though I made a* Ligature *upon all the great Vessels that went into the lower Parts of its Body, I could not find any Alteration in the Pulse of the Heart; the Circulation, it seems, being perform'd some other Way. I could not perceive any thing distinctly, whether the Air did unite and mix with the Blood; nor did in the least perceive the Heart to swell upon the Extension of the Lungs; nor did the Lungs seem to swell upon the Contraction of the Heart.*

EX-

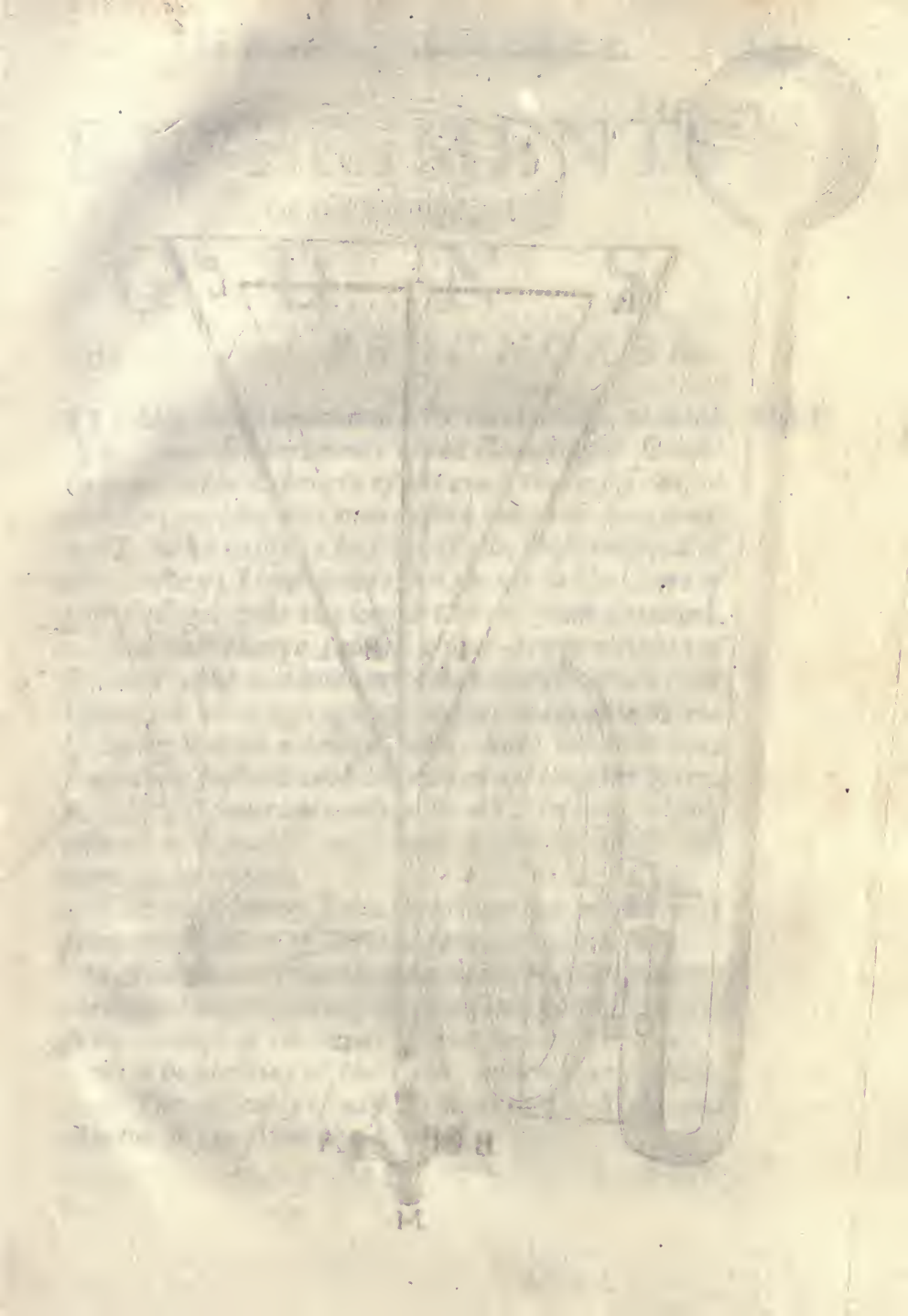


Fig: 1.

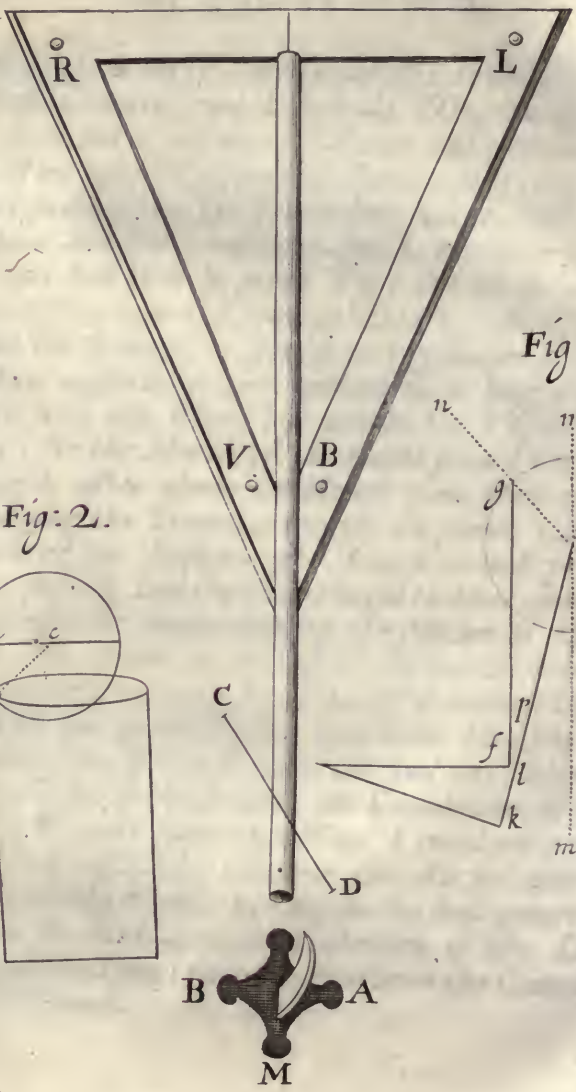



Fig: 2.

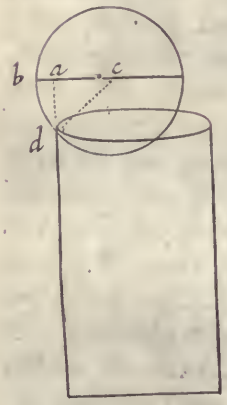
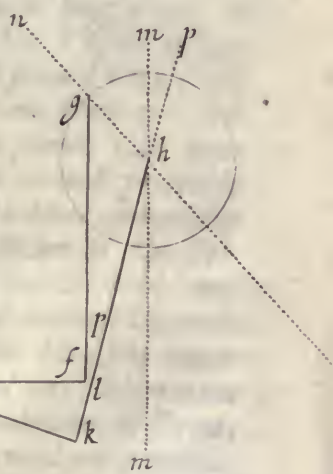



Fig: 3.



# EXPERIMENTS

Of the Recoiling of

# GUNS.

By the Lord *BROUNCKER.*

WHen *I was commanded by this* Society, *to make some Experiments of the Recoiling of Guns: In order to the discovery of the cause thereof, I caused this Engine that lies here before you to be prepared, and with it (assisted by some of the most eminent of this* Society) *I had divers shots made in the Court of this College, near the length thereof from the mark, with a full charge (about a four-penny weight) of Powder; but without any other success, than that there was nothing regular in that way, which was by laying it upon a heavy Table, unto which it was sometimes fastned with Screws at all the four places* R, L, V, B, *sometimes only at* R *or* L, *having wheels affixed at* L *and* V, *or* R *and* B, *that it might the more easily recoil.* Fig. 1.

*This uncertainty I did then conceive might arise from one or more of these three causes,* viz.

1. *The violent trembling motion of the Gun, whence the Bullet might casually receive some literal impulse from the nose of the Piece at the parting from it.*

2. *The yielding of the Table, which was sensible.*

3. *The difficulty of aiming well by the Sight and Button so far from the Mark.*

*Therefore to avoid all these, the Experiments I caus'd to be made before you in the Gallery of this Colledge, you may be pleased to remember were performed, first, taking only eight grains of Powder for the charge. Secondly, laying the Engine upon the Floor; and, Thirdly, aiming by a Thread at* M, *a Mark about an Inch and ¼ from the Mouth of the Gun (the edge of a knife being put for the Mark, the better to discern the line that was shot in) and they thus succeeded.*

*When the Piece was fastned to the Floor both at* R *and* L, *the Bullet then did so fully hit the Mark, that it was divided by it into two parts, whose difference in weight was less than ten grains (about the thirty third part of the whole Bullet) although the lesser part was a little hollow, and that from which the neck of Lead was a little too close pared off: But when hindred from Recoiling only at* R, *the Bullet mist the mark towards* L *or* A, *for the whole Bullet, less than two grains excepted, went on that side: And in like manner when hindred from Recoiling at* L, *the Bullet mist the Mark towards* R *or* B, *the whole Bullet, less than two grains excepted, passing the knife on that side thereof.*

*I had the honour to make other Experiments with the same Engine, lately at* White-Hall, *before his Majesty and his Highness Royal within the* Tilt-yard *Gallery, where there is the hearth of a chimney raised a little above the Floor, about the distance of thirteen feet from the opposite wall, against which I caused a plank to be placed, and the Engine to be laid first against the middle of the Hearth, that it might not recoil at all, and that part of the board to be marked against which 'twas levelled, known by a line stretch-*

*ed*

*ed from the Breech of the Piece unto the Board, directly over the ſight and button; and the fire being given (the charge being but eight grains of Powder as before) the Bullet did fully hit the mark. Secondly, the Piece (charged and levelled in the ſame manner) was laid at the end of the Hearth next the Park, ſo that very little of the corner* R *reſted againſt it, and then the Bullet miſs'd the mark about an inch and a quarter towards the Park, or* A. *The like being done at the other end of the Hearth, the Bullet then miſs'd the mark as much the other way; and afterwards with double that charge ſomething more, as before I had found it leſs with a ſmaller charge.*

*Since this (at firſt deſigning only to experiment the ſeveral diſtances that the Bullet is carried wide of the mark with different charges of Powder) I made theſe Experiments following.*

*In the firſt Column whereof you have the corner ſtopt from recoiling.*

*In the ſecond the grains of Powder with which the Piece was charged.*

*In the third the diſtance the Bullet was ſhot wide from the mark, in inches, tenths, and parts of tenths.*

*In the fourth the ſide on which the Bullet was carried.*

*In the laſt the diſtance of the mark from the muzzle of the Gun in feet.*

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B | 16 | 0. | | N | 9 | L | 40 | 0. | $1\frac{3}{4}$ | L | 9 | L | 12 | 1. | $1\frac{3}{4}$ | R | 6 | $\frac{1}{4}$ |
| L | 16 | 1. | $7\frac{1}{2}$ | R | 9 | L | 38 | 0. | $1\frac{1}{2}$ | R | 9 | L | 48 | 0. | $0\frac{3}{4}$ | R | 2 | $\frac{1}{4}$ |
| R | 16 | 1. | 5 | L | 9 | L | 39 | 0. | $0\frac{1}{2}$ | L | 9 | L | 48 | 0. | $1\frac{1}{2}$ | L | 4 | $\frac{1}{4}$ |
| R | 12 | 1. | 5 | L | 9 | R | 39 | 0. | 1 | L | 9 | L | 48 | 0. | $2\frac{1}{2}$ | L | 6 | $\frac{1}{4}$ |
| L | 12 | 1. | $7\frac{1}{2}$ | R | 9 | R | 12 | 0. | 6 | L | 2 | L | 48 | 0. | $5\frac{1}{2}$ | R | 8 | $\frac{1}{4}$ |
| L | 8 | 1. | 6 | L | 9 | R | 12 | 0. | $9\frac{1}{4}$ | L | 4 | L | 4 | 0. | $1\frac{1}{2}$ | R | 9 | $\frac{1}{4}$ |
| R | 8 | 1. | 1 | L | 9 | R | 12 | 1. | 2 | L | 6 | L | 4 | 0. | $1\frac{1}{2}$ | R | 9 | $\frac{1}{4}$ |
| R | 4 | 1. | 0 | L | 9 | R | 12 | 1. | $5\frac{1}{2}$ | L | 8 | L | 8 | 0. | $3\frac{1}{4}$ | R | 9 | $\frac{1}{4}$ |
| L | 4 | 1. | $1\frac{1}{4}$ | L | 9 | R | 12 | 1. | 9 | L | 9 | L | 12 | 0. | 3 | R | 9 | $\frac{1}{4}$ |
| L | 24 | 1. | $1\frac{1}{2}$ | L | 9 | B | 12 | 0. | 1 | L | $9\frac{1}{4}$ | L | 16 | 0. | $2\frac{1}{4}$ | R | 9 | $\frac{1}{4}$ |
| L | 32 | 0. | 6 | L | 9 | R | 12 | 0. | 3 | L | $\frac{1}{4}$ | L | 48 | 0. | 0 | R | 9 | $\frac{1}{4}$ |
| L | 40 | 0. | $1\frac{1}{2}$ | L | 9 | L | 12 | 0. | $3\frac{1}{2}$ | L | $\frac{1}{4}$ | L | 48 | 0. | 1 | R | 9 | $\frac{1}{4}$ |
| L | 48 | 0. | $4\frac{1}{2}$ | L | 9 | L | 96 | 0. | $0\frac{1}{2}$ | L | $\frac{1}{4}$ | L | 48 | 0. | $0\frac{1}{4}$ | R | 9 | $\frac{1}{4}$ |
| R | 20 | 1. | $0\frac{1}{2}$ | L | 9 | L | 96 | 0. | $0\frac{1}{2}$ | L | 2 | L | 4 | 1. | 6 | R | 9 | $\frac{1}{4}$ |
| R | 20 | 1. | 4 | L | 9 | R | 96 | 0. | 2 | L | $\frac{1}{4}$ | L | 4 | 1. | $5\frac{1}{2}$ | R | 9 | $\frac{1}{4}$ |
| R | $64\frac{3}{4}$ | 0. | $7\frac{3}{4}$ | L | 9 | L | 96 | 0. | 2 | L | 2 | L | 4 | 1. | 6 | R | 9 | $\frac{1}{4}$ |
| L | $64\frac{3}{4}$ | 0. | 9 | L | 9 | L | 48 | 0. | $1\frac{1}{2}$ | L | $\frac{1}{4}$ | L | 8 | 1. | 8 | R | 9 | $\frac{1}{4}$ |
| L | 96 | 1. | 1 | L | 9 | L | 48 | 0. | 0 | L | 2 | L | 8 | 1. | 8 | R | 9 | $\frac{1}{4}$ |
| R | 96 | 0. | 7 | L | 9 | R | 48 | 0. | $1\frac{1}{4}$ | L | $\frac{1}{4}$ | L | 12 | 2. | 0 | R | 9 | $\frac{1}{4}$ |
| R | 96 | 0. | 8 | L | 9 | R | 39 | 0. | $3\frac{1}{2}$ | L | 9 | L | 12 | 2. | 1 | R | 9 | $\frac{1}{4}$ |
| L | 96 | 1. | 3 | L | 9 | R | 39 | 0. | 2 | L | 9 | L | 16 | 1. | $7\frac{1}{2}$ | R | 9 | $\frac{1}{4}$ |
| L | 96 | 1. | $3\frac{1}{2}$ | L | 9 | R | 40 | 0. | 2 | L | 9 | L | 16 | 1. | 8 | R | 9 | $\frac{1}{4}$ |
| R | 12 | 0. | $3\frac{1}{2}$ | L | 96 | R | 40 | 0. | 0 | L | 9 | L | 20 | 1. | 5 | R | 9 | $\frac{1}{4}$ |
| R | 12 | 1. | 3 | L | 92 | R | 40 | 0. | 2 | L | 9 | L | 20 | 0. | 2 | R | 9 | $\frac{1}{4}$ |
| L | 12 | 0. | $6\frac{3}{4}$ | L | 4 | L | 96 | 0. | $6\frac{1}{2}$ | L | 9 | L | 24 | 0. | $2\frac{1}{4}$ | R | 9 | $\frac{1}{4}$ |
| L | 12 | 1. | $0\frac{3}{4}$ | L | 6 | L | 96 | 1. | $0\frac{1}{2}$ | L | 9 | L | 28 | 0. | 1 | R | 9 | $\frac{1}{4}$ |
| L | 12 | 1. | $2\frac{1}{2}$ | L | 8 | L | 96 | 1. | $0\frac{1}{2}$ | L | 9 | L | 32 | 0. | $1\frac{1}{2}$ | R | 9 | $\frac{1}{4}$ |
| L | 12 | 1. | $4\frac{1}{2}$ | L | 9 | L | 96 | 0. | $7\frac{1}{2}$ | L | 9 | L | 36 | 0. | $1\frac{1}{4}$ | R | 9 | $\frac{1}{4}$ |
| L | 48 | 0. | 5 | L | 9 | R | 96 | 1. | 0 | L | 9 | L | 40 | 0. | 1 | R | 9 | $\frac{1}{4}$ |
| L | 56 | 0. | 8 | L | 9 | R | 40 | 0. | 8 | L | 9 | L | 44 | 0. | $0\frac{1}{2}$ | R | 9 | $\frac{1}{4}$ |
| L | 96 | 1. | $2\frac{1}{2}$ | L | 9 | L | 40 | 0. | 5 | L | 9 | L | 48 | 0. | $0\frac{1}{2}$ | R | 9 | $\frac{1}{4}$ |
| L | 96 | 1. | 5 | L | 9 | L | 48 | 0. | 1 | L | 9 | L | 52 | 0. | $0\frac{1}{4}$ | R | 9 | $\frac{1}{4}$ |
| L | 40 | 0. | 5 | L | 9 | L | 48 | 0. | $0\frac{1}{4}$ | L | 2 | L | 56 | 0. | $0\frac{1}{4}$ | R | 9 | $\frac{1}{4}$ |
| R | 46 | 0. | 9 | L | 9 | L | 12 | 1. | 7 | L | 9 | L | 60 | 0. | $0\frac{1}{8}$ | R | 9 | $\frac{1}{4}$ |
| B | 8 | 0. | 2 | L | 9 | L | 12 | 0. | $2\frac{1}{4}$ | R | $\frac{1}{4}$ | L | 64 | 0. | $0\frac{1}{8}$ | R | 9 | $\frac{1}{4}$ |
| R | 96 | 0. | 6 | L | 9 | L | 12 | 0. | $6\frac{1}{2}$ | R | 2 | L | 96 | 0. | 0 | R | 9 | $\frac{1}{4}$ |
| L | 96 | 0. | 9 | L | 9 | L | 12 | 1. | 0 | R | 4 | | | | | L | 9 | $\frac{1}{4}$ |

*Whence*

*Whence you may be pleased to observe:*

*First, that the recoil of the Piece being hindred only at* R *or* L, *whatsoever be the charge of the Powder, the Bullet still misses the Mark, placed at the Mouth of the Gun, on the same side that the recoil is made.*

*Secondly, That about twelve grains of Powder shoots widest from the Mark at all distances abovementioned, on the same side that the recoil is made.*

*Thirdly, That above Forty-eight Grains of Powder shoots wide from the mark, placed at nine foot from the Muzzle of the Piece, on the contrary side to that on which the recoil is made.*

*The Cause of the first I cannot doubt to be the recoil of the Piece (from the Force of the Powder) before the Bullet be parted from it.*

*The second is, as I conceive, because with less than twelve Grains the Piece ceaseth to recoil before the Bullet be parted from it. And with more than twelve Grains the Bullet is parted from the Piece before it hath recoiled so far: A greater power not moving a greater weight swifter (horizontally) in the same proportion that it doth the lesser.*

*And for the third I have this to offer,* viz. *Because the Mouth of the Gun is moving sidewards whilst the Bullet is going out; therefore the Mouth of the Piece must be contiguous (at least) unto the Bullet on the contrary side to that on which the Piece recoils, some time after the separation made on the other side, and therefore the last impulse of the Bullet from the force of the Powder is on that side the Piece recoils; wherefore the Bullet must necessarily cross the Axis of the Piece, and that with a greater or lesser Angle, according to the force of the Powder; and when this Angle therefore is greater than the Angle of recoil,*

*then must the Axis of that Cylinder in which the Bullet moves cross the Axis of the Mark, beyond which interjection the mark being placed, the Bullet must be carried necessarily wide of the Mark on the contrary side to the recoil of the Piece.*

Fig. 2.

*Let* a d = a.
*and* d c = r.
*and therefore* a b = $r - \sqrt{r^2 a^2}$
*Therefore* a b. a d :: $r - \sqrt{r^2 a^2}$ a :: 1. x (x *being any given quantity.*)
*Wherefore* $a = x r - x\sqrt{r^2 a^2}$ :
*and* $x\sqrt{} . : r^2 a^2 := x r - a$.
*Therefore* $x^2 r^2 x^2 a^2 x r^2 - 2 x r a + a$.
*Therefore* $2 x r a = x^2 a^2 + a^2$
*Therefore* $\frac{axr}{x^2 + 1} = a$
*Quod &c.*

f e k = f l p = p h m = *the Angle of Recoil* p h n *the Angle of Reflexion made at the parting of the Bullet from the Piece. When* p h n > p h m (m h *being always parallel to* f g) *then must* h n *intersect* f g *if continued.*

*Some other Experiments I have also made with another Piece (about the same length, but of a bore near two tenths of an Inch less) and ordered in the same manner; and do find, that with a small charge the Bullet is shot (thence too) wide of the mark on the same side on which the Recoil is made, and with a full Charge wide the contrary side.*

*I caused besides two Pistol-barrels of about five inches long to be placed upon Carriages with four Wheels, and loaded with Lead, that they might not overturn when discharged, and both of equal weight, and an Iron* Cylinder *of the length of both their bores, and of the same diameter with a piece of Lead of weight equal to it. So that the piece of Lead affixed to either of these Guns (which of them I should please to charge) might equally poise the other with the Iron* Cylinder. *And thus indifferently charging either with eight grains more or less of Powder, and putting the Iron* Cylinder *home into both, the piece of Lead being affixed to that which held the Powder, and then both so set upon the floor, and the Powder fired, I could not thereby discover, that the charged Piece, or the other, either of them, did certainly recoil more or less than the other, they rather seemed still to be equal.* Fig. 3.

*These few Experiments I have made since, the Barrel being first cut at the muzzle parallel to a vertical Plane passing the line* CD.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| B | 48 | 0. 8 | L | R | 48 | 1. 2 | L |
| B | 48 | 0. 9 | L | L | 48 | 0. 2 | L |
| B | 16 | 0. 1 | R | L | 48 | 0. 3 | L |
| B | 8 | 0. 2 | R | | | | |
| B | 8 | 0. 0 | N | | | | |

Besides

Beſides theſe, there is another that I ſhall mention, and that is, the Experiment it ſelf, or the Double-Bottom'd Ship, invented by Sir *William Petty:* of this I will venture to add a few Words, and I think I may do it without tranſgreſſing that Rule I had fix'd to my ſelf, of not enlarging on the praiſe of particular Names, or Deſigns. For ſince the *Experiment* it ſelf is loſt, I hope I may ſecurely ſpeak of its Advantages: ſeeing Men are wont out of common humanity to allow the commendations of dead Men, I truſt I may commend a *wreck'd Ship*, without any fear of the envy that may thence ariſe to the *Author*. In brief therefore I will ſay this of it, that it was the moſt conſiderable *Experiment* that has been made in this *Age* of *Experiments:* if either we regard the great charge of the work, or the wonderful change it was likely to make in *Navigation*, or the great ſucceſs, to which this firſt *Attempt* was arriv'd. Tho' it was at firſt confronted with the doubts, and objections of moſt *Seamen* of our *Nation*, yet it ſoon confuted them by *Experience*. It appear'd very much to excel all other forms of *Ships*, in ſailing, in carriage, in ſecurity, and many other ſuch benefits. Its firſt *Voyage* it perform'd with admirable *ſwiftneſs*. And tho' it miſcarried after its return, yet it was deſtroy'd by a common fate, and by ſuch a dreadful *tempeſt*, as overwhelm'd a great *Fleet* the ſame Night: ſo that the ancient Fabricks of *Ships* have no reaſon to triumph over that new *Model*, when of threeſcore and ten Sail that were in the ſame *Storm*, there was not one eſcap'd to bring the News.

In a word, though this *Invention* ſucceeded not, while it was only ſupported by *private Purſes;* it will undoubtedly produce great effects, if ever it ſhall

be retriev'd upon the *publick Stock* of a *Nation:* which will be able to ſuſtain the firſt hazards and loſſes that muſt be allowed to happen in the beginnings of all extraordinary *Trials*.

§. XXXIV. *Their Obſervations.*

To their *Experiments* I will ſubjoin their *Obſervations*, which differ but in name from the other, the ſame fidelity and truth being regarded in collecting them both.

*Obſervations* of the *fix'd Stars* for the perfecting of *Aſtronomy*, by the help of *Teleſcopes:* of the *Comets* in 1665 and 1666, which were made both in *London*, and elſewhere; and particularly of the firſt *Comet*, for above a month after it diſappear'd to the naked eye, and became Stationary, and Retrograde.

*Obſervations* about *Saturn*, of the proportion, and poſition of its *Ring*, of the motion and orbit of its *Lunale*, of the ſhadow of the *Ring* on the *Body*, and of the *Body* on the *Ring*; and of its *Phaſes*, *&c.* of *Jupiter's Belts*, and of its ſpots, and verticity about its *Axis*, of its eclipſing its *Satellites*, and being eclips'd by them; of the Orbs, Inclinations, Motions, *&c.* of the *Satellites*, together with *Tables*, and *Ephemerides* of their motions.

*Obſervations* of the Spots about the Body of *Mars*, and of its whirling motion about its Center: of ſeveral Eclipſes of the *Sun* and *Moon*, and ſome of them as were not taken notice of by *Aſtronomers*, or Tables commonly uſed: of the Spots in the *Moon*, and of the ſeveral appearances in the Phaſes of it: of the *Moon* at the ſame time, by *Correſpondents* in ſeveral parts of the World, towards the finding her Parallax, and Diſtance.

*Observations* of the eliptical and waved Figures of the *Planetary Bodies*, near the *Horizon* from the Refraction of the *Hemisphere*: of the effects of *Lightning*: of the various pressure of the *Atmosphere*, by a *Wheel-barometer* for several Years, and of its usefulness for predicting the changes of Weather.

*Observations* on frozen *Beer*: on the Figures of *Snow*, frozen *Water*, *Urine* congeal'd: on the suspension of *Mercury* at a great height: on *Mines* and *Minerals*: on the Concretions of *Wood*, *Plants*, *Shells*, and several *Animals* Substances: on the effects of Earthquakes, Fiery Eruptions, and Inundations: on Lakes, Mountains, Damps, subterraneous Fires: on Tides, Currents, and the Depth of the Sea.

*Observations* of the liming of *Ground*, for improvement of the Bodies of *Sheep*, but spoiling their Wool: of several ways for preventing smutty *Corn*: of the importance of changing *Seed-Corn*: of the alteration of the *Horns* of *Sheep*, and other *Cattle*, by the change of Pasture: of the Pores and Valves in *Wood*: the Anatomy of *Trees*: of the sensitive, and humble *Plant*.

*Observations* on the *Bills* of *Mortality*: on the Leaves of *Sage*: on small living *Flies* in the Powder of *Cantharides*: of Insects bred in *Dew*: of *Virginian* Silk-Bottoms: of the Parts, and Anatomy of *Fishes*: of the Teeth of *Lupus Marinus*, that they are the same thing with the *Toad-stones* set in *Rings*: of the Respiration of *Fishes*: of *Bernacles*: of the calcin'd Powder of *Toads*: of an outlandish *Deer-Skin*, and Hair: of the Parts of *Vipers*: of Stones taken out of the Heart of a *Man*: of young *Vipers*: that they do not eat holes through their old ones Bellies, as is commonly affirm'd.

For

For *Examples* of this Head, I will only refer my Reader to thoſe which Mr. *Graunt* has publiſhed on the *Bills of Mortality*; wherein the *Author* has ſhewn, that the meaneſt and moſt trivial Matters may be ſo cultivated, as to bear excellent Fruit, when they come under the Management of an accurate and prudent *Obſerver*: For, from thoſe *Papers*, which went about ſo many Years, through every Tradeſman's Hands, without any manner of Profit, except only to the Clerks that collected them, he has deduc'd many true Concluſions, concerning the graveſt and moſt weighty Parts of *Civil Government*, and *humane Nature*.

§. XXXV. *An Objection anſwered concerning the uncertainty of Experiments.*

As I am now paſſing away from their *Experiments*, and *Obſervations*, which have been their proper and principal Work; there comes before me an *Objection*, which is the more to be regarded, becauſe it is rais'd by the *Experiments* themſelves. For it is their common Complaint, that there is a great *nicety*, and *contingency*, in the making of many *Experiments*: that their Succeſs is very often various and inconſtant, not only in the Hands of *different*, but even of the ſame *Triers*. From hence they ſuggeſt their Fears, that this continuance of *Experimenters*, of which we talk ſo much, will not prove ſo advantageous, though they ſhall be all equally cautious in *obſerving*, and faithful in recording their *Diſcoveries*: becauſe it is probable, that the *Trials* of future Ages will not agree with thoſe of the preſent, but frequently thwart and contradict them.

The *Objection* is ſtrong and material; and I am ſo far from diminiſhing the weight of it, that I am rather willing to add more to it. I confeſs many *Experiments* are obnoxious to failing; either by reaſon of

ſome *circumſtances*, which are ſcarce diſcernable, 'till the work be over: or from the diverſity of *Materials*, whereof ſome may be *genuine*, ſome *ſophiſticated*, ſome *ſimple*, ſome *mix'd*, ſome *freſh*, ſome may have loſt their *virtue*. And this is chiefly remarkable, in *Chymical Operations*, wherein if the diſſolvents be ill prepar'd, if the *Spirts* be too much, or too little puri-fy'd, if there be the leaſt alteration, in the degrees of *Fire*, the quantity of *Matter*, or by the negligence of thoſe that attend it, the whole courſe will be over-thrown, or chang'd from its firſt purpoſe.

But what is now to be concluded from hence? Shall this *Inſtability*, and *Caſualty* of *Experiments*, deter us from labouring in them at all? or ſhould it not rather excite us to be more curious and watchful in their *Proceſs*? It is to be allow'd, that ſuch *undertakings* are wonderfully hazardous and difficult; why elſe does the *Royal Society* endeavour to preſerve them from degenerating, by ſo many *forewarnings*, and *Rules*, and a *Method* ſo ſevere? It is granted, that their *event* is often uncertain, and not anſwerable to our expectations. But that only ought to admoniſh us, of the indiſpenſible neceſſity of a jealous, and exact *Inquiry*. If the uncertainty proceeded from a conſtant irregularity of *Nature*, we had reaſon then to deſpair; but ſeeing it for the moſt part ariſes only from ſome defect or change in our progreſs, we ſhould thence learn, firſt to correct our own miſcarriages, before we ceaſe to hope for the *ſucceſs*.

Let then the *Experiment* be often renew'd. If the ſame kinds and proportions of *Ingredients* be us'd, and the ſame circumſtances be punctually obſerv'd, the *effect* without all queſtion will be the ſame. If ſome little variation of any of theſe, has made any alteration

tion, a judicious and well practis'd *Trier* will ſoon be able to diſcern the *cauſe* of it; and to rectify it, upon the next repetition. If the difference of *time*, or *place*, or *matter*, or *Inſtruments*, will not ſuffer the product to be juſt the ſame in all points; yet ſomething elſe will reſult, that may prove perhaps as beneficial. If we cannot always arrive at the main end of our *Labours*, ſome leſs unſought *Curioſities* will ariſe. If we cannot obtain that which ſhall be uſeful for practice, there may ſomething appear that may inſtruct.

It is ſtranger that we are not able to inculcate into the minds of many men, the neceſſity of that *diſtinction* of my Lord *Bacon*'s, that there ought to be *Experiments* of *Light*, as well as of *Fruit*. It is their uſual word, *What ſolid good will come from thence?* They are indeed to be commended for being ſo ſevere *Exacters* of *goodneſs*. And it were to be wiſh'd, that they would not only exerciſe this vigour, about *Experiments*, but on their own *lives*, and *actions*: that they would ſtill queſtion with themſelves, in all that they do, what *ſolid good will* come from thence? But they are to know, that in ſo large, and ſo various an *Art* as this of *Experiments*, there are many degrees of uſefulneſs: ſome may ſerve for real, and plain *benefit*, without much *delight*: ſome for *teaching* without apparent *profit*: ſome for *light* now, and for *uſe* hereafter; ſome only for *ornament*, and *curioſity*. If they will perſiſt in contemning all *Experiments*, except thoſe which bring with them immediate *gain*, and a preſent *harveſt*; they may as well cavil at the Providence of God, that he has not made all the ſeaſons of the year, to be times of *mowing*, *reaping*, and *vintage*.

Of

§. XXXVI. *The Instruments they have invented.*

Of the variety, and excellence of the *Instruments*, with which this Age abounds, for their help in *Philosophical* matters, I have already discourſed in the former Part. I will now go on to mention thoſe new ones, which they themſelves, or ſome of their Members, have either *invented*, or *advanc'd*, for the eaſe, ſtrength, and direction of their *Senſes*, in the motions of *Nature*, and *Art*: of this kind are theſe that follow.

An *Inſtrument*, for finding a Second of Time by the Sun: another for finding the Celeſtial Refractions.

Three ſeveral *Quadrants* made after three new contrivances, which though they are not above eighteen Inches in Diameter, and ſo are manageable in any Window, or Turret, are yet far more exact than the beſt, that have been hitherto us'd, for *Aſtronomical Obſervations*, or taking Angles at Land.

A new *Inſtrument*, for taking Angles by reflection; by which means the Eye at the ſame time ſees the two Objects, both as touching in the ſame point, though diſtant almoſt to a Semicircle: which is of great uſe for making exact *Obſervations* at Sea.

A new kind of *Back-ſtaff*, for taking the Sun's Altitude by the Shadow, and Horizon: which is ſo contriv'd, that though the Shadow be at three foot diſtance, or as much more as is deſir'd, yet there ſhall not be the leaſt *Penumbra*: and the Shadow may be eaſily diſtinguiſh'd to the fourth part of a minute.

A *Hoop* of all the fix'd Stars in the *Zodiac*, for the ſpeedy finding the Poſition of the *Ecliptic*, and for knowing the Extent of the *Conſtellations*.

A *Copernican Sphere*, repreſenting the whirling Motion of the Sun, and the Motion of the ſeveral Planets.

A great many new ways of making *Inſtruments*, for keeping time very exactly, both with *Pendulums*, and without them; whereby the intervals of time may be meaſur'd both on the *Land*, and *Sea*.

A univerſal *Standard*, or meaſure of *Magnitudes*, by the help of a *Pendulum*, never before attempted.

A new kind of *Pendulum Clock*, wherein the *Pendulum* moves circularly, going with the moſt ſimple, and natural motion, moving very equally, and making no kind of noiſe.

A *Pendulum Clock*, ſhewing the æquation of Time.

Three new ways of *Pendulums* for *Clocks*, and ſeveral ways of applying the motion of the Watch-work to them.

Several new kinds of *Pendulum Watches* for the Pocket, wherein the motion is regulated, by Springs, or Weights, or Loadſtones, or Flies moving very exactly regular.

Several ſorts of *Inſtruments* for compreſſing, and rarefying the Air: A *Wheel-Barometer*, and other *Inſtruments* for finding the preſſure of the Air, and ſerving to predict the changes of the Weather.

A new kind of *Scales*, for examining the gravity of Bodies in all places: to ſee whether the attraction of the *Earth*, be not greater in ſome parts of the *Earth*, than in others; and whether it do not decreaſe, at farther diſtances from the ſurface of the *Earth*, either upwards into the *Air*, or downwards under the *Earth*.

A very exact pair of *Scales*, for trying a great number of *Magnetical Experiments*.

Several

Several very accurate *Beams*, for trying many *Statical Experiments*, and for finding the most exact gravity of several kinds of Bodies.

A great number of *Magnetical Instruments*, for making *Experiments* about *Loadstones*.

Several new kinds of *Levels*, for finding the true Horizon, where, by one of not above a foot length, the Horizontal line may be found, without the error of many seconds.

A new kind of *Augar*, for boring the ground, and fetching up whatever it meets with in the right order.

A new *Instrument*, for fetching up any Substance from the bottom of the Sea, whether Sand, Shells, Clay, Stones, Minerals, Metals.

A new *Bucket*, for examining and fetching up whatever Water is to be found at the bottom of the *Sea*, or at any depth, and for bringing it up without *mixing* with the other Water of the *Sea*, through which it passes.

Two new ways of sounding the depth of the *Sea* without a Line, for examining the greatest depth of the *Ocean*, in those parts of it, that are most remote from the *Land*.

Several *Instruments* for finding the velocity of swimming Bodies of several Figures, and mov'd with divers strengths, and for trying what *Figures* are least apt to be overturn'd, in order to the making a true *Theory*, of the *Forms* of *Ships*, and *Boats* for all uses.

An *Instrument* of great height, with Glass windows on the sides, to be fill'd with Water, for examining the velocity of Bodies of several Substances, Figures and Magnitudes, by their descent.

An

An *Inſtrument* for meaſuring, and dividing the time of their Deſcent, to the accurateneſs of two, or three thirds of time, ſerving alſo for examining the ſwiftneſs of Bodies deſcending through the Air, and of Bodies ſhot by a Gun, or Bow.

A *Bell* for diving under water to a great depth, wherein a man has continued at a conſiderable depth under water, for half an hour, without the leaſt inconvenience.

Another *Inſtrument* for a *Diver*, wherein he may continue long under water, and may walk to and fro, and make uſe of his ſtrength and limbs, almoſt as freely as in the Air.

A new ſort of *Spectacles*, whereby a *Diver* may ſee any thing diſtinctly under Water.

A new way of conveighing the *Air* under Water, to any Depth, for the uſe of *Divers*.

An *Inſtrument* for meaſuring the ſwiftneſs, and ſtrength of the *Wind*.

An *Inſtrument* for raiſing a continual ſtream of *Water*, by turning round a moveable valve, within the hollow of a cloſe *Cylindrical* Barrel.

Several kinds of *Thermometers* for diſcovering the heat, and cold of the *Air*, or any other Liquors: a *Thermometer* for examining all the degrees of heat in Flames, and Fires, made of ſeveral Subſtances; as alſo the degrees of heat requiſite to melt Solder, Lead, Tin, Silver, Braſs, Iron, Copper, Gold.

A *Standard* for Cold ſeveral ways.

An *Inſtrument* for planting of Corn.

Four ſeveral ſorts of *Hygroſcopes* made with ſeveral Subſtances, for diſcovering the drowth, and moiſture of the Air.

Several kinds of ways to examine the goodneſs, and badneſs of *Waters*.

Several *Engines* for finding, and determining the force of *Gun-powder*, by Weights, Springs, Sliding, *&c.*

An *Inſtrument* for receiving, and preſerving the force of *Gun-powder*, ſo as to make it applicable, for the performing of any motion deſir'd.

Several *Inſtruments* for examining the recoiling, true carriage, and divers other properties of Guns.

Several kinds of *Otocouſticons*, or *Inſtruments*, to improve the ſenſe of hearing.

Several Models of *Chariots*, and other *Inſtruments*, for Progreſſive Motion.

A *Chariot-way-wiſer*, meaſuring exactly the length of the way of the *Chariot*, or *Coach*, to which it is apply'd.

An *Inſtrument* for making Screws with great diſpatch.

A way of preſerving the moſt exact impreſſion of a *Seal*, *Medal*, *Sculpture*; and that in a Metal harder than Silver.

An *Inſtrument* for grinding *Optick-glaſſes*: a double *Teleſcope*: ſeveral excellent *Teleſcopes* of divers lengths of ſix, twelve, twenty-eight, thirty-ſix, ſixty foot long, with a convenient *Apparatus* for the managing of them: and ſeveral contrivances in them for meaſuring the Diameters, and parts of the *Planets*, and for finding the true poſition, and diſtance of the ſmall fix'd *Stars*, and *Satellites*.

Towards the exactneſs of all manner of theſe *Optick-glaſſes*, the *Engliſh* have got a great advantage of late years, by the *Art* of making *Glaſs*, finer, and more ſerviceable for *Microſcopes*, and *Teleſcopes*, than that of *Venice*. This Invention was brought into our Country,

try, and practis'd here, by the care, and expence of the Duke of *Buckingham*; whom the Author of these Papers ought to mention with all honour; both for his Skill and Zeal in advancing such *Experimental Studies* of which I am writing: and also because it has been by the favour of so great a *Patron*, that I have injoy'd the leisure, and convenience of composing this *History*.

§XXXVII. *Their Repository and Library.*

As soon as they were reduc'd into a *Fix'd Assembly*, one of the Principal Intentions they propos'd to accomplish, was a General Collection of all the Effects of *Arts*, and the Common, or Monstrous *Works* of *Nature*. This they at first began by the casual *Presents*, which either *Strangers*, or any of their own *Members* bestow'd upon them. And in short time it has increas'd so fast, by a contribution from all Parts, and chiefly by the bounty of Mr. *Colwal*, that they have already drawn together into one Room, the greatest part of all the several kinds of things, that are scatter'd throughout the *Universe*. The Keeping, and Ranging of these into order, is committed to Mr. *Hook*, who had also the honour of being made the first *Curator* of the *Royal Society* by election. This *Repository* he has begun to reduce under its several heads, according to the exact Method of the Ranks of all the *Species* of *Nature*, which has been compos'd by Dr. *Wilkins*, and will shortly be publish'd in his *Universal Language*: A Work wherein this excellent Man has undertaken a Design, that very well fits the temper of his own Mind; for it well became him to teach a *Communion* of Speech amongst all *Philosophers*; whose chief study it has always been, to promote a general agreement, and

correſpondence amongſt all virtuous and wiſe Men.

This *Book* had ſooner ſeen the light, if part of it had not periſh'd in the *Fire*. Of its uſe and accurate compoſition there is no man can doubt, that has ever heard the name of the *Author:* of whom, if I had not at firſt reſtrain'd my ſelf from particular commendations, I might have ſaid very much in his praiſe, which deſerves to be known to all the World, and to be the firſt *Experiment* of his own *Univerſal Language.*

*Their Library.*

Having well ſucceeded in this their purpoſe of *collecting* divers patterns of all *Natural*, and *Artificial* things; they have alſo (amongſt others) appointed a *Committee*, whoſe chief employment ſhall be to read over whatever *Books* have been written on ſuch ſubjects. By this means they hope ſpeedily to obſerve, and digeſt into *Manuſcript volumes*, all that has been hitherto try'd, or propounded in ſuch ſtudies. This is the only help that an *Experimenter* can receive from *Books:* which he may ſtill uſe, as his *Guides*, though not as his *Maſters*. For this end they have begun a *Library*, conſiſting only of ſuch *Authors*, as may be ſerviceable to their *Deſign*. To this there has been lately made a great Addition, by the Munificent Gift of Mr. *Henry Howard* of *Norfolk*, who has beſtow'd on the *Society* the whole *Arundelian Library*, containing ſeveral hundreds of choice *Manuſcripts*, beſides ſome thouſands of other *Books* of all kinds. And becauſe many of them belong'd to other *Profeſſions*, this Noble Benefactor has given them with a free permiſſion of changing them for others, that ſhall be more proper for their *Work:* Whereby they will ſhortly be able to ſhew a compleat *Collection* of all that has been pub-

publish'd in the Ancient, or Modern Tongues, which either regards the productions of *Nature*, or the effects of all *Manual Arts*.

Nor is this the only bounty which this Illustrious *Person* has conferr'd on the *Royal Society*; since by the firing of *London*, the first place of their meeting has been restored to its original use, and made an *Exchange*, he has afforded them a retreat in his own house, where they assemble at this present: By which favour he has added a new honour to the ancient *Nobility* of his *Race*: one of his *Ancestors* had before adorn'd that place with many of the best Monuments of *Antiquity*: and now by entertaining these new discoveries under his Roof, his *Family* deserves the double Praise of having cherish'd both the old, and new *Learning*; so that now methinks in *Arundel*-house, there is a perfect representation, what the real *Philosophy* ought to be: As there we behold new *Inventions* to flourish amongst the *Marbles*, and *Images* of the *Dead*: so the present *Arts*, that are now rising, should not aim at the destruction of those that are past, but be content to thrive in their company.

Sect. XXXVIII. *Their Discourses and Theories.*

It will not I hope be expected, that I should present my *Reader* an *Index* of all the several *Writings*, which have at any time been publish'd by the *Members* of the *Royal Society*. I shall omit those, which either were printed before the beginning of this *Institution*, or which treat of matters, that have no relation to their *Design*. Only I will say in general, that there is scarce any *Art*, or *Argument*, which has ever been the subject of humane *Wit*, of which I might not produce Instances, that some *Fellows* of this *Society* have given good proofs of their labours in it: of those *Discourses*, which

which have been ſince compos'd by ſome of their *Body*, or read before their weekly *Aſſemblies*, and directly concern the advancement of their *Work*, theſe are the principal.

Several *Hypotheſes* explaining the divers *Phaſes* and *Motions*, and other *Phænomena* of the *Comets*.

Several *Hypotheſes* of *Saturn*, and its *Satellites*.

An *Hypotheſis* of the cauſe of the *Rugoſity* of the *Moon*'s ſurface.

An *Hypotheſis* of the motion of the *Moon*, and of the *Sea* depending upon it.

An *Hypotheſis* of the motion of the *Planets*, and of Circular *Motion* in general.

Several *Hypotheſes* for the *Æquation* of Time.

A *Diſcourſe* about the poſſibility of the Retardation of *Cæleſtial Motions*, and of their going ſlower, and ſlower, the longer they laſt.

A *Diſcourſe* of making the ſeveral *Vibrations* of a *Pendulum æqual*, by making the weight of it move in a *Cycloid* inſtead of a *Circle*.

Several *Diſcourſes*, and *Hypotheſes* about the length of a *Pendulum*, for moving once in a ſecond of Time.

A *Diſcourſe* of the moſt convenient length of a *Pendulum*, for making a Standard for a univerſal Meaſure.

Several *Aſtronomical Diſcourſes* of Mr. *Hortex* retriev'd, and digeſted for the Preſs.

*Uleg Beg* tranſlated, about the places of the fix'd Stars, and ſeveral other Aſtronomical *Obſervations*.

A *Diſcourſe* about the poſſibility of the change of the attractive power of the *Earth*, and conſequently of the variation of the vibrative motion of *Pendulums*.

A *Diſcourſe* about ſhort inclining *Pendulums*, and of other *Pendulums* counterpois'd above the Center of *Motion*,

*Motion*, and of others lying *Horizontal* in the manner of a Beam.

An *Hypotheſis* about *Fire*, and *Flame*.

An *Hypotheſis*, and diſcourſe of the gravity, preſſure, and ſpring of the *Air*.

A *Diſcourſe* of an *Air Regiſter*.

Several *Diſcourſes* Mathematical, and Philoſophical, upon the *Experiment* of raiſing great weights by the *Breath*.

A *Diſcourſe* and Demonſtration againſt a propos'd Method of doubling the *Cube*, and of finding two mean *Proportionals*.

Several *Diſcourſes* about *Thermometers*, *Hygroſcopes*, *Baroſcopes*, and other *Weather-wiſers*.

An *Hypotheſis* and *Diſcourſe* of the *Inflection* and inflective veins of the *Air*, and of the fitneſs, and unfitneſs of the *Air* for *Cæleſtial Obſervations*.

An *Hypotheſis* of the Form, and Spring of the *Air*.

A *Diſcourſe* of the different parts of the ſame Water, and of the difference of Waters.

A *Diſcourſe* and *Hypotheſis* of Filtration, and of the Congruity, and Incongruity of *Bodies*.

A *Diſcourſe* of the poſſible height of the *Air*, and of its proportionable rarefaction upwards.

An *Hypothetical Diſcourſe* about the ſuſpenſion of the Clouds, and their preſſure.

An *Hypotheſis*, and *Diſcourſe* of *Earthquakes*.

A *Diſcourſe* of Petrifactions, and an *Hypotheſis* for explaining the ſeveral varieties of ſuch Bodies.

Several *Diſcourſes* about the *Loadſtone*, and an *Hypotheſis* for ſalving its appearances.

A *Diſcourſe* about the Pores of Stones.

A *Diſcourſe* about Eggs.

A *Diſcourſe* concerning the Glaſs-drops.

A *Diſcourſe* and *Hypotheſis* of annealing, and tempering Steel.

*Diſcourſes* about Cyder, and Coffee.

A *Diſcourſe* of the original of Forms.

An *Hypotheſis* of Light.

A *Diſcourſe* and *Hypotheſis* of the Nature and Proprieties of Colours.

A *Diſcourſe* about improving Wood for Dying, and for fixing Colours.

A *Diſcourſe* about the improvement f Muſick

A *Diſcourſe* of the differing Heat of Summer, and Winter.

A *Diſcourſe*, and *Hypotheſis* about Fluidity.

*Diſcourſes* upon ſeveral *Mercurial Experiments*.

*Diſcourſes* of *Hydroſtaticks*.

*Diſcourſes* about the force of falling Bodies.

A *Treatiſe* of the motion of the Muſcles.

A *Diſcourſe* of the Uſefulneſs of Experimental Philoſophy.

A *Treatiſe* of the vanity of Dogmatizing.

The Sceptical Chymiſt.

Eſſays about Salt-peter.

The *Parallel* of the Ancient, and Modern Architecture.

*Microſcopical* Obſervations.

*Micrographia*, or a *Diſcourſe* of things diſcover'd by a *Microſcope*.

Three *Books* of *Fevers*, of the Brain, and of the Scurvy, which I will alledge as the great Inſtances of this head: Wherein the famous *Author* has with accurate Diligence made prodigious improvements in all the parts of Phyſick, and ſhewn that the largeneſs of his *Knowledge* in it, is equal to the happy ſucceſs of his *practice*.

In

In this Collection of their *Diſcourſes*, and *Treatiſes*, my Reader beholding ſo many to paſs under the name of *Hypotheſes*, may perhaps imagine that this conſiſts not ſo well with their Method, and with the main purpoſe of their *Studies*, which I have often repeated to be chiefly bent upon the *Operative*, rather than the *Theoretical Philoſophy*. But I hope he will be ſatisfied, if he ſhall remember, that I have already remov'd this doubt, by affirming that whatever *Principles*, and *Speculations* they now raiſe from things, they do not rely upon them as the abſolute end, but only uſe them as a means of farther *Knowledge*. This way the moſt ſpeculative *Notions*, and *Theorems* that can be drawn from matter, may conduce to much profit. The light of *Science*, and *Doctrines* of cauſes, may ſerve exceeding well to promote our *Experimenting*; but they would rather obſcure, than illuminate the Mind, if we ſhould only make them the perpetual Objects of our *Contemplation*: as we ſee the light of the Sun, is moſt beneficial to direct our footſteps in walking, and our hands in working, which would certainly make us blind, if we ſhould only continue fix'd, and gazing on its Beams.

§. XXXIX. *The Hiſtories they have collected.*

The *Hiſtories* they have gather'd, are either of *Nature*, *Arts*, or *Works*. Theſe they have begun to collect by the plaineſt Method, and from the plaineſt Information. They have fetch'd their Intelligence from the conſtant and unerring uſe of *experienc'd Men* of the moſt unaffected, and moſt unartificial kinds of life. They have already perform'd much in this way, and more they can promiſe the world to accompliſh in a very ſhort ſpace of time.

There are already brought in to them the *Hiſtory* of *Comets* in general, and eſpecially of the two laſt: The Hiſtory of *Engliſh Mines*, and *Oars*: And particularly two ſeveral *Hiſtories* of *Tinneries* and *Tinworking*.

The *Hiſtories* of *Iron-making*: of *Lignum Foſſile*: of *Saffron*: of *Alkermes*: of *Verdigreace*: of *whiting* of *Wax*: of *Cold*: of *Colours*: of *Fluidity*, and *Firmneſs*.

The *Hiſtories* of Refining: of making Copperas: of making Allum: of Salt-peter: of making Latten: of Lead: of making Salt out of Sea-water: of refining Gold: of making Pot-aſhes: of making Ceruſe: of making Braſs: of Painting, and Limning: of Calcography: of Enamelling: of Varniſhing: of Dying.

The *Hiſtories* of making Cloth: of Worſted-Combers: of Fullers: of Tanners, and Leather-making: of Glovers, and Leather-dreſſing: of Parchment, and Vellum-making, and the way of making tranſparent Parchment: of Paper-making: of Hatters: of making Marble Paper: of the Rowling-Preſs.

The *Hiſtories* of making Bread: of Malt: of brewing Beer and Ale in ſeveral places: of Whale-fiſhing: of the Weather for ſeveral years: Wind-mills, and other Mills in *Holland*: of Maſonry: of Pitch and Tar: of Maiz: of Vintners: of Shot: of making Gun-powder: and of making ſome that is twenty times as ſtrong as the common Piſtol-powder.

The two laſt of theſe were communicated to the *Royal Society* by the favour of *Prince Rupert*; whom I take the boldneſs to mention here, for his excellent Knowledge, and uſe in all manner of Mechanical Operations. But his name will be recorded in all the

the *Hiſtories* of this Time, for greater works, for many glorious enterpriſes by Sea and Land, and for the Immortal Benefits whereby he has oblig'd the *Engliſh Nation.*

The Inſtances that I ſhall give of this their manner of collecting *Hiſtories*, ſhall be, of *Works*, that of *Salt-peter*; of *Arts*, that of *Dying*; of *Nature*, that of *Oyſters*: which laſt may perhaps ſeem a ſubject too mean to be particularly alledg'd: but to me it appears worthy to be produc'd. For tho' the *Britiſh Oyſters* have been famous in the World, ever ſince this Iſland was diſcover'd, yet the skill how to order them aright, has been ſo little conſider'd amongſt our ſelves, that we ſee at this day, it is confin'd to ſome few narrow *Creeks* of one ſingle County.

THE

# HISTORY

Of the Making of

# SALT-PETER,

*By Mr.* HENSHAW.

'WHETHER the *Nitre* of the Antients be of 'the ſame ſpecies with the Salt which is com- 'monly known by the name of *Salt-peter*, is vari- 'ouſly diſputed by very learned Authors amongſt the 'modern Phyſicians: on the negative ſide are *Ma- 'thiolus* and *Bellonius*; the latter of which had the 'advantage, by the opportunity of his travels in *E- 'gypt*, to have often ſeen and handled them both, and 'is ſo poſitive as to pronounce, that in all *Chriſten- 'dom* there is not one grain of *Nitre* to be found, un- 'leſs it be brought from other parts, although at the 'time of his being in *Grand Caire* (which was about 'the year 1550) it was ſo common there (as he ſays) 'that ten pounds of it would not coſt a *Moidin*. 'Among thoſe that hold the affirmative, the moſt 'eminent are *Cardan* and *Longius*; and it ſhould 'ſeem the general vote of learned Men hath been 'moſt favourable to that Opinion, by reaſon that in 'all Latin Relations and Preſcriptions, the word *Ni- 'trum* or *Halinitrum* is moſt commonly uſed for '*Salt-peter*.

'I

'I have often enquired, amongſt our *London* 'Drugſters, for *Egyptian Nitre*, and if I had been ſo 'fortunate as to have found any, I doubt not but I 'ſhould have been able to have put an end to that 'Queſtion by a Demonſtration; that is, by turning 'the greateſt part of it into *Salt-peter*. However, 'the Obſervations I have made in my own private 'Experiments, and in the practice of *Salt-peter-men* 'and Refiners of *Salt-peter*, ſeem to give me ſuffici-'ent ground to ſuſpect, that the confidence of thoſe, 'who hold them to be ſeveral Salts, proceedeth 'chiefly from their being unacquainted with the 'various Φαινόμενα of *Salt-peter* in the marking and 'refining of it: and alſo their comparing double re-'fined *Salt-peter* (of which Gunpowder is made) 'with that deſcription of *Nitrum* and *Aphronitrum* 'in the tenth chapter of the one and thirtieth Book 'of *Pliny's Natural Hiſtory* (the only tolerable ac-'count of that Salt that hath been handed to us 'from Antiquity) where he tells us, That *Aphroni-'trum* was *Colore pene purpureo*, and *Egyptian Nitre* '*Fuſcum & Lapidoſum*, adding afterward, *Sunt ibi* '*Nitrariæ in quibus rufum exit a colore terræ*, which 'is ſufficient to have hinted to any one but mode-'rately verſed in the moderate way of ordering *Salt-'peter*, that the Antients were not at all skilled in refi-'ning their *Nitre* from the Earth and common Salt 'that is uſually mingled with it, nor from that foul 'yellow Oyl, which, it ſeems, did accompany their '*Nitre*, as well as it doth our *Salt-peter*, in great 'abundance; for *Pliny* takes notice of it, when he 'mentions the removing the *Nitre* (after it is grain-'ed) out of the *Nitrariæ*, ſaying, *Hic quoque natura* '*olei intervenit, ad ſcabiem animalium utilis*: And

'indeed

'indeed this greasy Oyl (which the Workmen call 'Mother of Salt-peter, and perhaps is but the crude 'and unripe part of it) doth by nature so wonder- 'fully adhere to every part else of the Peter (it may 'be ordained for the nutriment and augmentation 'of it) that the separation of it, is the sole cause of 'the great charge and labour that is required to the re- 'fining of Peter: otherwise the Peter will be yellow, 'or brown, or some other dark colour. And Scali- 'ger in his 104. Exercit. sect. 15. saith, Subluſtris 'purpuræ quasi splendor quidem in salis-petræ terris 'sæpenumero est a nobis observatus; and he that shall 'boil a Lixivium past through a Salt-peter-earth, up 'to a consistence, without filtring it through ashes, 'or giving the Salt leave to chrystallize, may per- 'haps find something not unlike the Nitre of the 'Antients.

'To make this doubt yet clearer, it will require 'your patience to observe a few short remains out of 'the same Pliny, concerning the production of Nitre; 'saith he, Exiguum Nitri fit apud Medos, cande- 'scentibus siccitate convallibus quod vocant Halmir- 'haga: minus etiam in Thracia juxta Philippos sor- 'didum Terra quod appellant Agrium.

'This agrees very exactly with what I have been 'informed by a Refiner of Salt-peter, that near So- 'phia, Santa-Cruz, and several other places in Bar- 'bary, he hath seen Salt-peter shoot out of the ground '(as thick and white as a hoar frost) on many barren 'and desart Lands; only he adds, that this hap- 'pens not till the beginning of the rains of Auguſt, or 'September; and that it is the falling of the fresh- 'water that causes the Salt-peter to shoot out into 'little Chrystals; and that the people of the Coun-

'try

‘ try do no more than take it off the ground as clean
‘ as they can, and ſell it to Merchant-ſtrangers. This
‘ is, ſays he, the *Barbary Peter*, which the Refiners
‘ buy commonly at twenty ſhillings *per Cent.*

‘ Much after the ſame manner (by the relation of
‘ an *Indian* Merchant) is that great quantity of *Pe-*
‘ *ter* produced, which of late years hath been brought
‘ into *England*, and other parts of *Chriſtendom*,
‘ from about *Pegu* in *Eaſt-India*, ſaving that the
‘ Natives do refine it once, before they ſell it to the
‘ Merchants: But being not ſo skilful, to diſcharge
‘ it from the common Salt, which attends *Peter*, our
‘ Workmen do refine it again, before it be fit for Gun-
‘ powder.

‘ The next remark out of *Pliny*, is, *Aquæ vero*
‘ *Nitroſe pluribus in locis reperiuntur, ſed ſine viri-*
‘ *bus Denſandi* (he means the heat of the Sun in thoſe
‘ places) *Optimum Copioſumque in Clytis Macedoniæ*
‘ *quod vocant Chalaſtricum candidum purumque pro-*
‘ *ximum ſali. Lacus eſt Nitroſus, exiliente è medio*
‘ *dulci fonticulo, ibi ſit Nitrum circa Canis ortum,*
‘ *novenis diebus, totidemque ceſſat, & rurſus innatat*
‘ *& deinde ceſſat, iis autem diebus quibus gignitur*
‘ *ſi fuere imbres ſalſius Nitrum faciunt, Aquilones*
‘ *deterius quia Validius commovent limum. In*
‘ *Egypto autem conficitur multò abundantius ſed*
‘ *deterius, nam fuſcum lapidoſumque eſt, fit penè*
‘ *eodem modo quo Sal: niſi quod Salinis mare in-*
‘ *fundunt, Nilum autem Nitrariis.*

‘ How ſuch great plenty of *Nitre* ſhould be found
‘ in the Waters above mention'd, will be no difficulty
‘ to conjecture, if we conſider that Lakes are the re-
‘ ceptacles of Land-floods, and that great Rains may
‘ eaſily bring it to the Lake in *Macedonia*, from the
‘ higher

'higher parts in the Country about it. And for the 'River *Nile*, there muſt needs be leſs ſcruple con-'cerning it, if we call to mind that once in a year, it 'ſweeps with an impetuous overflow the burnt and 'barren Deſarts of *Africa* under the *Torrid Zone*; 'where, by the relation of Travellers, thoſe Sands 'are viſibly full of *Nitre*, and thoſe few Springs and 'Wells that are to be found there, are by that rea-'ſon ſo bitter, that the *Moors* and their Camels are 'forced to make a hard ſhift with them in their long 'journeys.

'But when he comes to deſcribe the *Aphronitrum*, 'he comes more home, both to the name and nature 'of our *Salt-peter*, in theſe words, *Proxima ætas Me-'dicorum tradidit, Aphronitrum in Aſia Colligi in 'ſpeluncis & molibus diſtillans, dein ſole ſiccant.* And 'Scaliger ſpeaking of *Salt-peter*, ſays, *Eſt quædam 'Nitri ſpecies inhærens Rupibus, in quibus inſolatur, 'ac propterea Salpetra dicitur.* And, I my ſelf, for my 'own ſatisfaction in the point, have drawn very good '*Rock-peter* out of thoſe *Stiriæ*, which are uſually 'found hanging like Icycles in arched Cellars and 'Vaults; and have been told, that a Phyſician in *Shrop-'ſhire* did perform great Cures by vertue of *Sal-pru-'nellæ*, which he made only of Flower of Brimſtone 'and thoſe *Stiriæ*.

'But to ſteer more directly upon our immediate 'ſubject *Salt-peter*; tho' it be likely, that the Air 'is every where full of a volatile kind of *Nitre*, 'which is frequently to be ſeen coagulated into fine 'white Salt, like Flower of Wheat (but by the ve-'ry taſte may be eaſily known to be *Peter*) ſticking 'to the ſides of Plaiſtered-walls, and in Brick-walls 'to the Mortar between the Bricks, (in dry wea-

'ther,

'ther, or where the wall is defended from the rain) 'for Lime doth ſtrongly attract it; though Dew and 'Rain do conveigh much of it to the Earth, and the 'Clouds ſeem to be ſpread out before the face of the 'Sun, either to imbibe ſome part of his influence, or 'to have a Salt generated in them, for to advance the 'fertility of the Earth, and certainly they return not 'without a bleſſing; for I have more than once ex-'tracted *Salt-peter* out of Rain and Dew, but from 'the latter more plentifully, and yet even there, is '*Salt-peter* accompanied with a greaſy purple Oil, 'in great plenty: Though (as I have found upon 'trial) that moſt ſtanding waters, and even deep 'wells have ſome ſmall quantity of *Salt-peter* in 'them; though the face of the Earth, if it were not 'impregnated with this Salt, could not produce Ve-'getables; for Salt (as the Lord *Bacon* ſays) is the 'firſt Rudiment of Life; and *Nitre* is as it were the 'Life of Vegetables: Yet to be more ſure of it, I made 'Experiment likewiſe there too, and found ſome little 'of it in fallows, and the earth which Moles caſt up in 'the Spring: Though I ſay the Air and Water want 'it not, yet it is not there to be had in any proportion, 'anſwerable to the charge in getting it: And though 'the Earth muſt neceſſarily have great quantities there-'of, generated or infuſed into it; yet in theſe tem-'perate Countries of *Europe*, it is no ſooner dilated by 'Rain-water, or the Moiſture of the Earth, but it is 'immediately applied to the production or nutriment 'of ſome Plant, Inſect, Stone, or Mineral; ſo that 'the Artiſt will find as little of it here to ſerve his turn, 'as in the other two Elements.

'The only place, therefore, where *Salt-peter* is to 'be found in theſe Northern Countries, is in Stables,

'Pigeon-houſes, Cellars, Barns, Ware-houſes, or indeed any place which is covered from the Rain, which would diſſolve it, and (as I have ſaid) make it vegetate; as alſo from the Sun, which doth rarify it, and cauſeth it to be exhaled into the Air; (For the ſame reaſon Husbandmen alſo might make double or treble the profit they uſually do of their Muck, if they will lay it up under a Hovel, or ſome covered place, until they carry it out upon their Land.) And I have been told by an experienced Workman, that no Earth yields *Peter* ſo plentifully, as that in Churches, were it not an impiety to diſturb the Aſhes of our Anceſtors, in that ſacred Depoſitory.

'Provided always, that the Earth be of good Mould, and the better the Mould is, the more *Peter* is produc'd; for in Clay, or ſandy Earth, little or none is to be found: The freer ingreſs the Air hath into a place, is ſtill of more advantage, ſo that the Sun be excluded; And let the Earth be never ſo good, if it be laid on a brick or boarded floor, it will not be ſo rich in *Peter*, as if it have free communication with the Exhalations of the lower parts of the Earth.

'In any place thus qualified, you cannot miſs of good quantities of *Peter*, if it have not been drawn out in ſome Years before; which a Workman will quickly find, after he hath digged the firſt ſpadeful of Earth, by laying a little of it on the end of his tongue, and if it taſte bitter, he is ſure of good ſtore of mineral, (as they love to call it) that is, *Salt-peter*; if the Ground be good, it continues rich to ſix or eight foot deep, and ſometimes, but not often, to ten.

'After

'After the *Salt-peter* is extracted, if the Earth be 'laid wet in the ſame place again, it will be twenty 'Years e'er any conſiderable quantity grow there of 'it; but if the Earth be well dryed, it will come in 'twelve or fourteen: and if they mingle with the 'dryed Earth ſtore of Pigeons-dung, and mellow 'Horſe-dung, and then temper it with Urine (as 'was uſual before we were ſupplyed with *Peter* from '*India*) it will be fit to dig again in five or ſix Years. 'He that ſhall caſt Water upon a Ground fit to dig 'for *Peter*, will only ſink the Mineral deeper into 'the Earth; but he that throws Soap-ſuds on it, will 'quite deſtroy the *Peter* (as the Workmen have a 'Tradition) and it very well deſerves a further En-'quiry.

'That *Salt-peter*, and the way of drawing it out 'of the Earth, now in uſe, was a modern Invention, 'is generally concluded by all Authors; but whether 'we owe it to chance, or the ſagacity of ſome great 'Wit, is as unknown, as the time when it was firſt 'diſcovered.

'It ſeems to have many Years preceeded the Inven-'tion of Gun-powder, which by the *Germans* is aſcri-'bed to *Conſtantine Autlitzer*, or *Berthold Schwertz*, 'a Monk of *Friburgh*, and was, in all probability, not 'long diſcovered, when the Inventor (*Polydore Vir-'gil* tells us) taught the uſe of Guns to the *Veneti-'ans*, at the Battel of *Foſſa Claudia*, when they ob-'tain'd that notable Victory over the *Genoueſes*, *An-'no* 1380. For there is mention made, both of *Salt-'peter* and *Aqua-fortis*, in the Writings of *Geber*, a 'Spaniſh Moor, and an *Alchymiſt*; but at what time 'he lived, is unknown, though it be certain, ſome 'hundreds of Years before *Raimund Lully*, who

about the Year 1333, publiſhed ſome of his Books, wherein he treats of *Salt-peter* and *Aqua-fortis*. It is no ill conjecture of *Maierus*, that the foreſaid Monk, being a skilful Alchymiſt, had a deſign to draw a higher Spirit from *Peter* than the common *Aqua-fortis*; and that he might better open the Body of *Peter*, he ground it with Sulphur and Charcoal, by which Compoſure he ſoon became the Inventor of Gun-powder.

## *The Manner of making* SALT-PETER.

IN the firſt place you muſt be provided of eight or ten Tubs, ſo large, that they may be able to contain about ten Barrows full of Earth each of them. Theſe Tubs muſt be all open at the top; but in the bottom of every one of them, you muſt make a hole near to that ſide you intend to place outermoſt, which hole you muſt fit very well with a Tap and Spigot on the outſide downward. On the inſide of the Tub, near the Tap-hole, you muſt carefully place a large wad of ſtraw, and upon that a ſhort piece of board, which is all to keep the earth from ſtopping up the Tap-hole. When you have placed your Tubs on their ſtands, at ſuch a diſtance one from the other, that you may come with eaſe between them, then fill them up with ſuch *Peter-earth* as you have choſen for your work, leaving only void about a ſpan's breadth between the earth and the edge of the Tub; then lay on the top of the

'the Earth in each Tub, as near as you can to the 'middle, a rundle of Wicker, like the bottom of a 'Basket, and about a foot in diameter, and by it ſtick 'into the Earth a good ſtrong Cudgel, which muſt 'be thruſt pretty near the bottom; the Wicker is to 'keep the Water, when it is poured on, from hollow-'ing and diſordering the Earth, and the Cudgel is to 'be ſtirred about, to give the Water ingreſs to the 'Earth upon occaſion: Then pour on your Earth 'common cold Water, till it ſtand a hand's breadth 'over the Earth: When it has ſtood eight or ten 'hours, looſen the Spigots, and let the Water rather 'dribble, than run into half Tubs, which muſt be ſet 'under the Taps: This *Lixivium* the Workmen call 'their Raw-liquor; and note, that if it come not 'clear at the firſt drawing, you muſt pour it on again, 'and after ſome little time draw it off, till it come 'clear, and of the colour of Urine.

'If you are curious to know how rich your Li-'quor is before boyling, you may take a Glaſs-phial, 'containing a Quart; fill it with the common Water 'you uſe, then weigh it exactly; next fill the ſame 'Glaſs with your Liquor, and find the difference of 'weight, which compared with the quantity of all 'your Liquors, will give you a very near gueſs, how 'much *Salt-peter* you are like to make by that boyl-'ing.

'Then pour on again, on the ſame Earth, more 'common Water, that it may bring away what is 'remaining in the Earth of the former Liquor. This 'ſecond Liquor is of no other uſe, but to be poured 'on new Earth, inſtead of common Water, becauſe it 'contains ſome quantity of *Salt-peter* in it.

'When

'When this is done, turn out the uſeleſs inſipid 'Earth out of the Tubs, which you muſt fill with 'new Earth, and continue this Operation, till you 'have in the ſame manner lixiviated all the Earth: 'Then fill your Copper with your Liquor, which 'Copper, for one of the Profeſſion, muſt be about 'two hundred weight, and ſet ſtrongly in a Furnace 'of brick-work; beſides, on one ſide of your Fur-'nace you are to place a Tub full of your Liquor, 'which at a Tap below may dribble as faſt into the 'Copper, as the force of the Fire doth waſte your 'Liquor, which Invention is only to ſave charges in 'Fewel. When you have boyled it up to that height, 'that a little of it flirted off the finger on a live 'Charcoal, will flaſh like Gun-powder (which for 'the moſt part falls out to be about two Days and a 'Nights boiling) at what time, upon tryal, a hun-'dred weight of the Liquor contains about five and 'thirty pound weight of *Peter*. But the Workmen 'ſeldom make uſe of any further indication, than by 'finding the Liquor hang like Oyl on the ſides of the 'braſen Scummer, when 'tis dipped into it, which is 'a ſign it is fit to be paſſed through the Aſhes, which 'is done in this manner.

'You muſt prepare two Tubs, fitted after the man-'ner of the firſt, where you put your Earth, ſaving 'that at the bottom of theſe Tubs, you muſt lay 'Reeds or Straw a foot high; over them place looſe 'boards, pretty near one another; over them, a little 'more Straw (which is to keep the Aſhes from the 'top, and to give the Liquor room to drein the 'better from them:) Then fill up your Tubs with 'any ſort of Wood-aſhes to half a foot of the top; 'then pour on the foreſaid Liquor, as it comes ſcald-

'ing

'ing hot out of the Copper, on the Aſhes contained 'in the firſt Tub; then after a while draw it off 'at the top; and ſo continue putting on and draw-'ing off, firſt at one Tub of Aſhes, then at the other, 'till your Liquor grow clear, and loſe the thick turbid 'colour it had when it went on.

'When all the Liquor hath in this manner paſt 'through the Aſhes of both Tubs, that by this means 'all its greaſy oyl is left behind in the Aſhes, you 'muſt keep it for the ſecond boyling in a Veſſel by it 'ſelf: in the mean time pour upon your Aſhes a ſuffi-'cient quantity of common Water, very hot, once 'or twice, to bring away what is remaining of the 'Liquor in the Aſhes.

'When you begin the ſecond boyling, put firſt 'into the Copper the Water that went laſt through 'your Aſhes, and as that waſteth, let your ſtrong Li-'quor drop into the Copper, out of the Tub above 'deſcribed, ſtanding on the ſide of the Furnace, till 'the Liquor in the Copper be ready to ſhoot or chry-'ſtaliſe.

'*Note*, That toward the end of your boyling, there 'will ariſe great ſtore of Scum and Froth; which 'muſt be carefully taken off with a great braſs Scum-'mer, made like a Ladle, full of little holes, and uſu-'ally about that time it lets fall ſome common Salt 'to the bottom, which you muſt take up with the 'ſaid Scummer, and lay it aſide for another uſe.

'To know when the Liquor is ready to ſhoot into '*Peter*, you need but drop a little of it on a knife, or 'any other cold thing that hath a ſmooth ſuperfi-'cies, and if it coagulate, like a drop of tallow, and 'do not fall off the knife when it is turned down-'ward, which alſo may be judged by its hanging like

'oyl

'oyl to the ſides of the Scummer. When the Li-
'quor is brought to this paſs, every hundred weight
'of it containeth about threeſcore and ten pounds
'weight of *Peter*.

'When you find your Liquor thus ready to ſhoot,
'you muſt with great Iron Ladles lade it out of the
'Copper into a high narrow Tub for that purpoſe,
'which the Workmen call their ſettling Tub; and
'when the Liquor is grown ſo cold, that you can en-
'dure your finger in it, you ſhall find the common or
'cubick Salt begin to gravulate and ſtick to the ſides
'of the Tub; then at the Tap, placed about half a
'foot from the bottom, draw off your Liquor into
'deep wooden Trays, or Braſs-pans, and the cooler
'the place is where you let them ſtand to ſhoot in,
'the better and more plentifully will the *Salt-peter*
'be produc'd; but it will be of no good colour till
'it be refined, but will be part white, part yellow,
'and ſome part of it blackiſh.

'The Salt which ſticketh to the ſides and bottom
'of the ſettling Tub is (as I have ſaid) of the na-
'ture of common Salt; and there is ſcarce any *Pe-*
'*ter* to be found but is accompanied with it, though
'no doubt ſome of this is drawn out of the Aſhes
'by the ſecond Liquors: If it be foul, they refine it
'by it ſelf, and about *London* ſell it at good rates to
'thoſe that ſalt Neats Tongues, Bacon, and Collar-
'Beef; for beſides a ſavory taſte, it gives a pleaſing red
'colour to moſt Fleſh that is ſalted with it. *Pliny*
'ſays, *Nitrum obſonia alba & deteriora reddit Olera*
'*viridiora*, whether *Salt-peter* doth ſo, I have not
'yet tryed.

'When the Liquor hath ſtood two Days and two
'Nights in the Pans, that part of the Liquor which is

'not

'not coagulated, but ſwims upon the *Peter*, muſt be 'carefully poured off, and being mingled with new 'Liquors, muſt again paſs the Aſhes before it be boil-'ed, elſe it will grow ſo greaſy it will never generate 'any Salt.

## *To Refine* SALT-PETER.

'AFTER you have made your Copper very clean, put in as much Water as you think will diſ-'ſolve that quantity of *Peter* you purpoſe to Refine; 'when the Water is very hot caſt in the *Peter* by lit-'tle and little, ſtirring it about with a Ladle, that it 'may the ſooner diſſolve; then increaſe the Fire till 'your Liquor begin to boil: In the mean time feel 'with the Scummer, whether there be at the bottom 'any Salt undiſſolv'd, and take it out, for it is Com-'mon-Salt, and doth not ſo ſoon diſſolve as the *Peter*; 'then as the Water boils ſcim off the Froth that ſwims 'at the top of it as faſt as it riſeth; when it hath 'boiled to the height that a drop of it will coagu-'late on a Plate (as hath been ſaid above in the ma-'king of *Salt-peter*) then caſt in by degrees either 'a Pint of the ſtrongeſt Wine-vinegar, or elſe four 'Ounces of Allum beaten to powder (ſome chooſe 'burnt Allum) and you ſhall obſerve a black Scum 'to riſe on the top of the Liquor, which when you 'have allowed ſome time to thicken, you may eaſily 'take off with the Scummer; repeat this ſo often till 'no more Scum ariſes. Some do uſe to throw in a 'Shovel full of Quick-Lime, and ſay it makes *Peter*

'the whiter, and Rock the better; you must take 'great care all this while the Fire be not too strong, 'for while this is doing, the Liquor will be apt to 'boil over, and will not easily be appeased without 'your great loss.

'When this is done, lade out the Liquor into a 'settling Tub, and cover it over with a Cloth, that it 'cool not too soon, and within an hour or two, a 'thick yellow Faces will fall to the bottom of the 'Tub; then quickly draw off the Liquor while it is 'hot, into the shooting Trays or Pans, and do as you 'did in making *Peter*, saving, that you must cover the 'Trays with a Cloth, for then the Liquor will begin 'to shoot at the bottom, which will make the *Peter-Rock* into much fairer Chrystals, than otherwise it 'would: When no more *Peter* will shoot (which is 'commonly after two days) pour off the Liquor that 'swims at the top, and put the *Peter* into a Tub with 'a hole at the bottom for to drain, and when it is dry, 'it is fit for use.

'The Figure of the Chrystals is sexangular, and 'if it hath rightly shot, is fistulous and hollow like 'a Pipe.

'Before I proceed to tell you, how this darling of 'Nature (the very Basis and Generation of Nutriment) 'is converted into Gun-powder (the most fatal In-'strument of Death that ever Mankind was trusted 'withal) I will crave leave to acquaint you with a few 'Speculations I have of this Salt, which if I could clear-'ly make out, would lead us into the knowledge of 'many noble Secrets in Nature; as also to a great im-'provement in the Art of making *Salt-peter*.

'First then you are to observe, that though *Peter* 'go alway in Gun-powder, yet if you fulminate it

in

'in a Crucible, and burn off the volatile part with 'Powder of Coal, Brimſtone, Antimony or Meal, 'there will remain a Salt, and yet ſo fixed (very 'unlike Common-Salt) that it will endure the force 'of almoſt the ſtrongeſt Fire you can give it; which 'being diſſolved into Water and Spirit of *Nitre* drop-'ped into it, till it give over hiſſing (which is the 'ſame with the volatile Part that was ſeparated 'from it in the fulmination) it will be again reduced 'to Chryſtals of *Peter*, as it was at firſt; which noble 'Experiment the World hath already been taught by 'an honourable Member of this Society; with a train 'of ſuch important Obſervations, as never before were 'raiſed from one Experiment.

'That which I aim at then is, that if the Spirit of 'the volatile Salt of Soot, or of the Urine, Blood, 'Horns, Hoofs, Hair, Excrements, or indeed any part 'of Animals (for all abound with ſuch a volatile 'Salt fixed, and Oyl as *Peter* doth) could by the 'ſame way, or any like it, be reduc'd to *Peter* or 'ſome *Nitrous* Salt not much differing from it: It 'would excellently make out a Theory that I am 'much delighted with, till I am convinced in it; 'which is, that the Salt which is found in Vegetables 'and Animals, is but the *Nitre* which is ſo univer-'ſally diffuſed through all the Elements (and muſt 'therefore make a chief Ingredient in their Nutri-'ment, and by conſequence of their Generation) 'a little altered from its firſt Complexion: And that 'the reaſon why Animals that feed on Vegetables 'are obliged by Nature to longer meals than thoſe 'that feed on other Animals, is, becauſe Animals 'are fuller of that Salt than Vegetables: And in-'deed ſuch Animals are but Caterers of it for Man;

'and others whom Nature's bounty gratifies with a 'more lusty and delicious Diet.

'I confess I have been the more confirmed in this 'fancy, since I have often seen a Friend of mine, 'with a Natural and Facile Ἐχεῖα convert the 'greater part of *Peter* into a Salt so like the Vola-'tile Salt of Urine, that they are scarce to be distin-'guished by smell or taste, and yet he adds nothing 'to it that can possibly be suspected to participate of 'that Nature: But indeed all Volatile Salts are so 'alike, that it is not easy to distinguish them in any 'respect.

THE

# HISTORY

Of Making

# GUN-POWDER.

'THE materials of *Gun-powder* are *Salt-peter*, *Brimſtone*, and *Coal*; the *Peter* and *Brimſtone* muſt be both refined if you mean to make good *Powder*, and the Coal muſt be *Withy* and *Alder* equal parts; for *Withy* alone is counted too ſoft, and ſome do commend *Hazle* alone to be as good as the other two.

'The whole Secret of the Art conſiſts in the proportion of the Materials, the exact mixture of them, that in every the leaſt part of *Powder* may be found all the Materials in their juſt proportion; then the Corning or making of it into Grains; and laſtly the Drying and Duſting of it.

'The proportion is very differently ſet down by ſeveral Authors; *Baptiſta Porta* tells us the ordinary *Powder* is made of four Parts of *Peter*, one of *Sulphur*, and one of *Withy* Coal: But the beſt *Powder* of 6, or 8 of *Peter*, and one a piece of the other, which agrees pretty well with *Bonfadini* a late *Italian* Writer, in his Book of the Art of *Shooting flying*, where, to make the beſt *Gun-powder*, he preſcribes ſeven Parts of *Peter*, one of *Brimſtone*, and of *Hazel* Coal an ounce leſs in every pound: *Cardan* ſays; *Conſtat ex tribus Halinitri partibus, duabus*

'*Saligni*

'*Saligni Carbonis atque una Sulphuris, Convenitque* '*magnis Machinis; Sed Midiocribus Halinitri par-* '*tes decem, Saligni carbonis tres, Sulphuris duas, par-* '*vis vero Halinitri partes decem; Carbonis ligni nu-* '*cis Avellonæ ſine nodis, tum Sulphuris partem unam* '*ſingularem:* *Langius* appoints three of *Peter*, two '*of Withy* Coal, and one of *Brimſtone*: The *Engliſh* Author of Fire-works, ſays, that the proportions '*in England* to make good, indifferent, and ordinary '*Powder*, is 5, 4, and 3 parts of *Peter*, to two of '*Coal*, and one *Brimſtone*. Our *Engliſh* Workmen '*are generally ſo curious of their ſecret, that I could* '*not obtain the proportion of them without a pro-* '*miſe of Secrecy*: But when all is done their ſecret '*is not ſo much the way to make the beſt Powder*, '*as the beſt way to get moſt money by it, by ſubſtract-* '*ing from the Peter*, and making up weight with '*the Coal*; when indeed there is ſo great a Latitude, '*that provided the Materials be perfectly mixt, you* '*make good Powder* with any of the proportions '*above-mention'd*; but the more *Peter* you allow it, '*it will ſtill be the better, till you come to obſerve* '*eight Parts.*

'The next thing after the proportion, is the mix-'ture, about which moſt of the workmens time and 'pains is beſtowed: For firſt in a Horſe-mill with 'two ſtones (like that with which they grind their 'Materials at the *Glaſs-houſe*) moving upon a Mar-'ble bottom, which is edged with boards ſet ſloap-'ing, that what ſlips from under the ſtones may ſlide 'back again.

'They grind the Brimſtone and Coal each of them 'apart by themſelves as fine as poſſibly they can; 'then they ſift each of them apart by themſelves:

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'The Brimſtone is ſifted thorough Tiffany in a Bolting mill, ſuch as the Bakers uſe for Wheat-flour: the Coal is ſifted thorough Lockram, in a bag made like a ſhirt ſleeve; for the convenience of the Work-man it is done in a cloſe Bin, with only two holes for him to put his arms in, and ſhake the bag about. Whatſoever of each material is not ſmall enough to ſift thorough, is brought again to the Mill to be new ground.

'As for the *Peter*, that muſt in the Copper be diſſolved in as much water as will juſt take it up, and then the water muſt be boiled away till the *Peter* comes to the thickneſs of haſty-pudding. The reaſon of this operation is becauſe when the *Peter* is thus ſoft, the other materials will the eaſilier incorporate with it, and in the next place it will not wear the wooden peſtles ſo much when it comes to the Mill, as when it is hard and dry.

'When the Materials are in this readineſs, they are weighed (only the *Peter* is weighed before it is put to diſſolve in the Copper) and by proportion are carried to the mingling Trough, which is made of boards, like a great Cheſt without a cover, being about eight foot long, four broad, and three foot high. The Coal is laid in firſt, the Brimſtone next, and the *Peter* at top of all; then two men with ſhovels ſtir and mingle them together for an hour, and then 'tis ready for the Mill.

'The Powder-mills are ſeldom made to move with any thing but water: The great water-wheel is made like that of an ordinary water-wheel, either over-ſhot or under-ſhot, according to the quantity of water they have: To the *Axis* of this wheel, a little way within the Mill is faſtened a

'leſſer

'leſſer wheel, called the Spar-wheel, with ſtrong 'Cogs, which in their motion round take hold of 'the round ſtaves of another wheel of about the 'ſame diameter, ſet a little way above it, and faſtned 'to the end of a beam of 15 or 16 foot long, laid 'parallel to the Horizon, with an iron gudgeon at 'the other end of it, to facilitate its motion round: 'This beam is called the round beam; out of it come 'a certain number of arms of about nine inches long, 'and three inches broad, which in their going round 'meet with other leſſer arms (called Tapes) coming 'out of the Peſtles (for ſo they call certain ſmall quar-'ters of Timber placed perpendicular to the Horizon, 'about nine foot long and four inches broad; they 'are ſet in a ſlight frame to keep them ſteady); by 'theſe ſmall arms the Peſtles are lifted up about two 'foot and a half, and then let fall into a ſtrong wood-'en Trough ſet under them, wherein the Powder is 'put to be pounded.

'Every Mill hath two Troughs, and about ſixteen 'Peſtles: every Peſtle hath faſtned to the lower end 'of it a round piece of *Lignum Vitæ*, of about five 'inches long and three and a half diameter; and in-'to the bottom of the Trough, juſt where the Peſtle 'is to fall, is let in another piece of *Lignum Vitæ*, 'of the faſhion and bigneſs of an ordinary Bowl, 'ſplit according to its longeſt diameter: The Peſtles 'are not lifted up all together, but alternatively, to 'make the Powder turn the better in the working; 'and for the ſame reaſon round Troughs are counted 'better than ſquare.

'To make excellent Powder, it ought to be 'wrought thus thirty hours; but of late they will 'not afford it above eighteen or twenty hours; once

'in

'in eight hours they uſe to moiſten the Powder with 'a little fair Water; others, who are more curious, 'put Water ſomething thickned with quick-lime; 'others uſe White-wine Vinegar, others *Aqua-vitæ*: 'But if it be not moiſtned with ſomething once in 'eight hours, the Powder will grow dry, and in half 'an hour after it will take fire. As ſoon as the Pow-'der grows dry, you may find it, though at a di-'ſtance, by the noiſe of the Mill; for then the Peſtles 'will rebound from the bottom of the Trough and 'make a double ſtroke. The only danger to the Mill 'is not from the Trough; for many times the iron 'Gudgeons grow hot for want of greaſing, and then 'the Duſt that flies about will be apt to fire, and ſo the 'Mill blows up.

'From the Mill the Powder is brought to the 'Corning-houſe, of a middle temper between moiſt 'and dry. The way of corning it is with two hair 'Sieves join'd together, the upper Sieve incloſing 'ſome part of the Hoop of the lower Sieve: The 'upper Sieve hath holes of the ſize you will have 'the Powder grained at; the holes of the lower 'Sieve are much leſſer: The upper Sieve they call 'their corning Sieve, the lower their wet Duſter: 'They lay the Powder upon the upper Sieve ſome 'two inches thick; upon that a Piece of heavy 'wood made like a Trencher, of about eight inches 'diameter, and two and a half in thickneſs, called a 'Runner, which when the Sieve is moved, by its 'weight and motion, forces the Powder thorough the 'upper Sieve, and that corns it. Then the lower 'Sieve receives the Powder, and lets the duſt go 'thorough the Bin, over which the Sieve is ſhaken, 'called the Duſtingin.

'When the Powder is thus corned, it is laid about 'an inch and half thick on the drying Sieves, which 'are made of coarſe Canvaſs faſtned to ſlight frames 'of Deal about an Ell long, and ſome twenty inches 'broad; and thus it is carried into Stoves to dry.

'The Stove is commonly a little Room about 'eighteen or twenty foot ſquare, with ranges of ſmall 'Fir poles about two foot one above another, to lay 'the drying Sieves upon, but only on that ſide the 'fire is made. Beſides a glaſs window to give light, 'there muſt be a ſmall lover-hole at the top of the 'Room, to let out the ſteam, elſe the Powder will 'not only be the longer a drying, but often by the re-'turn of the ſteam on the Sieves, the top of the Pow-'der will be ſo cruſted that the lower part will not dry. 'The Room is heated by an Iron about a yard high 'and half a yard broad, caſt in the form of an Arch, 'equal to a Semi-quadrant, and placed in the back 'of a Chimney, the fore-part whereof is like a Fur-'nace; and to avoid danger, opens into another little 'Room apart, called the Stoke-hole.

'The Powder is brought into the Stove before it 'be heated, and is not taken out again till the Stove 'be cold; and about eight hours is required to the 'drying of it. In hot Countries the Sun is the beſt 'Stove, and a great deal of danger and charges that 'way avoided.

'After the Powder is dried, it is brought again to 'the Corning-houſe, where it is again ſifted over 'the Duſting-bin in other double Sieves, but without 'any Runners. Theſe Sieves have both of them 'ſmaller holes than the former: The upper Sieve is 'called the Separater, and ſerves to divide the great 'corns from the leſſer; the great corns are put by them-

'themſelves, and ſerve for Cannon Powder. The 'lower Sieve is called the Dry-duſter, and retains 'the ſmall corns (which ſerve for Muſquet and Piſtol) 'and lets fall the duſt into the Bin, which is to be 'mingled with freſh Materials, and again wrought 'over in the Mill.

'So that good Powder differs from bad (beſides 'the well working and mingling of the Materials) in 'having more *Peter* and leſs Coal; and laſtly, in the 'well duſting of it.

'The laſt Work is to put the Powder into Barrels; 'every Barrel is to contain five ſcore weight of Pow-'der, and then 'tis ready for ſale.

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# APPARATUS

TO THE

# HISTORY

Of the Common Practices of

# DYING.

By Sir *WILLIAM PETTY.*

'IT were not incongruous to begin the Hiſtory with a Retroſpect into the very nature of 'Light it ſelf (as to inquire whether the ſame be a 'Motion or elſe a Body;) nor to premiſe ſome The-'orems about the Sun, Flame, Glow-worms, the 'Eyes of ſome Animals, ſhining Woods, Scales 'of ſome Fiſhes, the daſhing of the Sea, ſtrokes 'upon the Eyes, the *Bolonian* Slate (called by ſome 'the Magnet of Light) and of other light and lucid 'Bodies.

'It were alſo not improper to conſider the very 'eſſentials of Colour and Tranſparencies (as that the 'moſt tranſparent Bodies, if ſhaped into many an-'gles, preſent the Eye with very many colours;) 'That bodies having but one ſingle ſuperficies, have 'none at all, but are ſuſcipient of every colour laid

'before

'before them; That great depths of Air make a 'Blue, and great depths of Water a Greeniſh colour; 'That great depths or thickneſſes of coloured Liquors 'do all look blackiſh (red Wine in a large conical 'Glaſs being of all reddiſh colours between Black at 'the top and White at the bottom.

'That moſt Vegetables, at one time or other, are 'greeniſh; and that as many things paſſing the Sun 'are blackned, ſo many others much whitened by 'the ſame: Other things are whitened by acid 'Fumes, as red Roſes and raw Silks by the ſmoak of 'Brimſtone.

'Many Metals, as Steel and Silver, become of 'various colours, and tarniſh by the Air, and by ſe-'veral Degrees of heat.

'We might conſider the wonderful variety of co-'lours appearing in Flowers, Feathers; and drawn 'from Metals, their Calces and Vitrifications; and of 'the Colours riſing out of tranſparent Liquors artifi-'cially mixed.

'But theſe things, relating to the abſtracted nature 'of Colours, being too hard for me, I wholly de-'cline; rather paſſing to name (and but to name) 'ſome of the ſeveral ſorts of Colorations now com-'monly uſed in Humane affairs, and as vulgar Trades 'in theſe Nations; which are theſe; *viz.*

1. 'There is a whitening of Wax, and ſeveral ſorts 'of Linnen and Cotton Cloths, by the Sun, Air, 'and by reciprocal effuſions of Water.

2. 'Colouring of Wood and Leather by Lime, 'Salt, and Liquors, as in Staves, Canes, and Marble 'Leather.

3. 'Co-

3. ‘ Colouring of Paper, *viz.* Marbled Paper, by ‘ diſtempering the colours with Ox-gall, and apply- ‘ ing them upon a ſtiff gummed Liquor.

4. ‘ Colouring, or rather diſcolouring the Colours ‘ of Silks, Tiffanies, *&c.* by Brimſtone.

5. ‘ Colouring of ſeveral Iron and Copper-work, ‘ into Black, with Oyl

6. ‘ Colouring of Leather into Gold-colour, or ‘ rather Silver leaves into Gold by Varniſhes, and in ‘ other caſes by Urine and Sulphur.

7. ‘ Dying of Marble and Alabaſter with heat and ‘ coloured Oyls.

8. ‘ Colouring Silver into Braſs with Brimſtone or ‘ Urine.

9. ‘ Colouring the Barrels and Locks of Guns into ‘ Blue and Purple with the temper of Small-coal ‘ heat.

10. ‘ Colouring of Glaſs (made of Sands, Flints, ‘ *&c.*) as alſo of Chryſtals and Earthen Ware, with ‘ the ruſts and ſolutions of Metals.

11. ‘ The colouring of live Hair, as in *Poland*, ‘ Horſe and Man's Hair; as alſo the colouring of ‘ Furrs.

12. ‘ Enameling and Anealing.

13. ‘ Applying Colours, as in the Printing of ‘ Books and Pictures, and as in making of playing ‘ Cards; being each of them performed in a ſeveral ‘ way.

14. ‘ Gilding and Tinning with *Mercury*, *Block-* ‘ *Tin*, *Sal-Armoniack*.

15. ‘ Colouring Metals, as Copper with *Calamy* ‘ into Braſs, and with *Zink* or *Spelter* into Gold, or ‘ into Silver with *Arſenick*: And of Iron into Cop- ‘ per with *Hungarian Vitriol*.

16. Ma-

16. ‘ Making Painter's Colours by preparing of ‘ Earth, Chalk, and Slates; as in *Umber*, *Oker*, *Cullen earth*, *&c.* as alſo out of Calces of Lead, as ‘ *Ceruſe* and *Minium*; by Sublimates of Mercury and ‘ Brimſtone, as in *Vermilion*; by tinging of white ‘ Earths variouſly, as in *Verdeter*, and ſome of the ‘ *Lakes*; by concrete Juices or *Fæculæ*, as in *Gambrugium*, *Indico*, *Pinks*, *Sap-green*, and *Lakes*: ‘ As alſo by Ruſts, as in *Verdegreeſe*, *&c.*

17. ‘ The applying of theſe Colours by the adheſion of Ox-gall, as in the Marble Paper aforeſaid; or ‘ by Gum-water, as in Limning; or by clammy drying Oyls, (ſuch as are the Oyls of Linſeed, Nuts, ‘ Spike, Turpentine, *&c.*)

18. ‘ Watering of *Tabbies*.

19. ‘ The laſt I ſhall name is the colouring of ‘ Wool, Linnen, Cotton, Silk, Hair, Feathers, Horn, ‘ Leather, and the Threads and Webbs of them with ‘ Woods, Roots, Herbs, Seeds, Leaves, Salts, Limes, ‘ Lixiviums, Waters, Heats, Fermentations, Macerations, and other great variety of Handling: An account of all which is that Hiſtory of Dying we intend. All that we have hitherto ſaid being but a ‘ kind of remote and ſcarce pertinent Introduction ‘ thereunto.

‘ I begin this Hiſtory by enumerating all the ſeveral Materials and Ingredients which I underſtand ‘ to be or to have been uſed in any of the laſt aforementioned Colorations, which I ſhall repreſent in ‘ various Methods, *viz.* out of the *Mineral* Family. ‘ They uſe Iron and Steel, or what is made or comes ‘ from them, in all true Blacks (called *Spaniſh* Blacks) ‘ though not in *Flanders* Blacks; *viz.* they uſe Copperas, Steel-filings, and Slippe, which is the ſtuff

‘ found

'found in the Troughs of Grind-ſtones, whereon 'Edge-tools have been ground. They alſo uſe Pew-'ter for Bow-dye, Scarlet, *viz.* they diſſolve Bars of 'Pewter in the *Aqua-fortis* they uſe; and make alſo 'their Dying-kettles or Furnace of this Metal.

'*Litharge* is uſed by ſome, though acknowledged 'by few, for what neceſſary reaſon I cannot learn, 'other than to add weight unto Dyed Silk; *Litharge* 'being a Calx of Lead, one of the heavieſt and moſt 'colouring Metals.

'I apprehend *Antimony* much uſed to the ſame 'purpoſe, though we know there be a very tingent 'Sulphur in their Mineral, which affordeth variety of 'Colour by the precipitations and other operations 'upon it.

'*Arſenick* is uſed in Crimſon upon pretence of gi-'ving Luſtre, although thoſe who pretend not to be 'wanting in giving Luſtre to their Silks, do utterly diſ-'own the uſe of *Arſenick.*

'*Verdegreaſe* is uſed by Linnen Dyers in their 'Yellow and Greeniſh Colours, although of itſelf it 'ſtrike not deeper Colour than of pale Straws.

'Of *Mineral Salts* uſed in *Dying*; the chief is 'Allum; the very true uſe thereof ſeems to me obſcure 'enough, notwithſtanding all the Narrations I could 'get from Dyers about it: For I doubt,

1. 'Whether it be uſed to make common Water 'a fit *Menſtruum*, wherewith to extract the Tingent 'particles of ſeveral hard Materials; for I find Al-'lum to be uſed with ſuch Materials as ſpend eaſy 'enough, as Braſil, Logwood, *&c.* And withal, 'that the Stuffs to be dyed are firſt boyled in Allum-'Liquors, and the Allum afterwards (as they ſay) 'cleared from the ſaid Stuff again, before any Colour 'at all be apply'd.

2. 'Whe-

2. 'Whether it be uſed to ſcour the *Sordes*, which 'may interpoſe between the *Coloranda*, and the Dying Stuff; and ſo hinder the due adheſion of the 'one unto the other: The boyling of ſeveral things 'firſt in Allum ſeeming to tend this way. But I find 'this work to be done in Cloth, and Rugs, by a due 'ſcouring of the ſame in the Fulling-mills with Earth, 'and in Silk with Soaps, by which they boyl out the 'Gums and other *Sordes*, hindring or vitiating the 'intended Colours.

3. 'Whether Allum doth intenerate the Hairs of 'Wool, and Hair-ſtuff, as Grograins, *&c.* Whereby 'they may the better receive and imbibe their Colours? Unto which opinion I was led by the Dyers; ſaying, that after their Stuffs were well boyled 'in Allum, that they then cleared them of the Allum again: But we find the moſt open bodied Cottons and Silks, to have Allum uſed upon them; as 'well as the harder Hairs. Nor is Allum uſed in 'many Colours, *viz.* in no Woad or Indico Blues; 'and yet the Stuffs dyed Blue, are without any previous intenerations quickly tinged; and that with 'a ſlight and ſhort immerſion thereof into the Blue-fat.

4. 'Whether it contribute to the Colour it ſelf, as 'Copperas doth to Galls, in order to make a Black; 'or as Juice of Lemons doth to Cocheneel in the '*Incarnadives*; or as *Aqua-fortis* impregnated with 'Pewter, doth in the Bow-Scarlet, changing it from 'a red Roſe-Crimſon to Flame-Colour. This uſe is 'certainly not to be denied to Allum in ſome caſes; 'but we ſee in other caſes, that the ſame Colours may 'be dyed without Allum, as well as with it, though 'neither ſo bright and lively, nor ſo laſting.

5. 'Wherefore, Fifthly, I conclude (as the moſt 'probable opinion) that the uſe of Allum is to be a '*Vinculum* between the Cloth and the Colour, as 'clammy Oyls and Gum-waters are in Painting and 'Limning; Allum being ſuch a thing, whoſe parti-'cles and *Aculei* diſſolved with hot Liquors will ſtick 'to the Stuffs, and pitch themſelves into their Pores; 'and ſuch alſo, as on which the particles of the dy-'ing Drugs will alſo catch hold, as we ſee the parti-'cles of Copperas and other chryſtallizing materials, 'do of Boughs and Twigs in the Veſſel, where ſuch 'Chryſtallization is made. A ſecond uſe I imagine 'of Allum in Dying, to be the extracting or drying 'up of ſome ſuch particles, as could not conſiſt with 'the Colour to be ſuperinduced; for we ſee Allum is 'uſed in the dreſſing of *Alutas* or white Leather, the 'which it dryeth, as the Salt of Hen-dung doth in Ox-'hides, and as common Salt doth in preſervation of 'Fleſh-meats; for we know, a Sheep-skin newly flay-'ed could not be colour'd as Braſils are, unleſs it 'were firſt dreſſed into Leather with Allum, *&c.* which 'is neceſſary to the Colour, even although the Allum 'be, as it is, cleared out of the Leather again, before 'the ſaid Colouration, with Bran, Yolks of Eggs, *&c.* 'Wherefore as Allum, as it were by accident, makes 'a wet raw Skin to take a bright Colour, by extracting 'ſome impedimental particles out of it; ſo doth it 'alſo out of other materials, though perhaps leſs diſ-'cernably.

'Another uſe I ſuppoſe of Allum, which is to 'brighten a Colour: For as we ſee the fineſt and 'moſt glaſſy materials to make the moſt orient 'Colours, as Feathers, Flowers, *&c.* ſo certainly 'if by boyling Cloth in Allum, it become incruſta-

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'ted with particles, as it were of Glaſs, the tinging 'of them yields more brightneſs, than the tinging of 'a Scabrous matter (ſuch as unallumed Cloth is) can 'do. Analogous hereunto I take the uſe of Bran, and 'Bran-liquors in Dying to be; for Bran yielding a 'moſt fine Flour (as we ſee in the making of white 'Starch;) I conceive that this Flour entring into 'the pores of the Stuff, levigates their *Superficies*, and 'ſo makes the Colour laid on it, the more beautiful, 'juſt as we ſee, that all woods, which are to be gild-'ed, are firſt ſmoothned over with white Colours, 'before the Gold be laid on.

'And indeed all other Woods are filled, not only 'as to their greater holes and Aſperities, with *Putty*; 'but alſo their ſmaller Scabrities are cured by priming 'Colours, before the ultimate Colour intended be laid 'thereon.

'The next Mineral Salt is *Salt-peter*, not uſed by 'ancient Dyers, and but by few of the modern. And 'that not till the wonderful uſe of *Aqua-fortis* (where-'of *Salt-peter* is an ingredient) was obſerved in the 'Bow-ſcarlet: Nor is it uſed now, but to brighten 'Colours by back-boyling them; for which uſe *Argol* 'is more commonly uſed. Lime is much uſed in the 'working of Blue-fats, being of Lime-ſtone calcined, 'and called *Calke*, of which more hereafter.

'Of the *Animal* Family are uſed about Dying, 'Cochineel (if the ſame be any part of an *Animal*) 'Urine of labouring Men, kept till it be ſtale and 'ſtinking; Honey, Yolks of Eggs, and Ox-gall. The 'three latter ſo rarely, and as the conceits of par-'ticular Workmen; and for collateral uſes (as to 'increaſe weight, promote fermentation, and to 'ſcour, *&c.*) that I ſhall ſay very little more of them

'in this place, only saying of Urine, that it is used to 'scour, and help the fermenting and heating of 'Woad; it is used also in the Blue-fats instead of 'Lime: It dischargeth the yellow (of which and 'blue, most greens are compounded) and therefore 'is always used to spend *Weld* withal. Lastly, the 'stale Urine, or old Mud of pissing places, will 'colour a well scoured small piece of Silver into a 'Golden colour, and it is with this (and not at all 'with the *Bath*-water) wherewith the Boys at *Bath* 'colour single pence; although the generality be-'lieve otherwise. Lastly, it seems to me that Urine 'agreeth much in its Nature with *Tartarous Lixi-'via*; not only because Urine is a Lye made of Ve-'getables in the body of *Animals*; nor because in 'the Receptacles of Urine, *Tartarous* stones are bred 'like as in Vessels of Wine; nor because Urine dis-'charges and abrades Colours as the *Lixivia* of *Tar-'tar*, or the deliquated Salts of *Tartar* do; but be-'cause *Tartar* and *Sulphur-Lixivia* do colour the 'superficies of Silver, as we affirmed of Urine; and 'the difference I make between Urine and *Tarta-'rous-Lixivia* is only this, that though the Salts of 'both of them seem by their effects in Dying, in a 'manner the same; yet that Urine is made and con-'sists of Salt and Sulphur both.

'Before we enter upon the *Vegetable* materials for 'Dying, we may interpose this Advertisement, That 'there are two sorts of Waters used by Dyers, *viz.* 'River-water and Well-water: By the latter I mean 'in this place the Pump-water in great Cities and 'Towns, which is a harsh Water wherewith one can 'scarce wash ones hands, much less scour them clean; 'nor will Soap dissolve in it, but remains in rolls and

'lumps.

'lumps: moreover, the Flesh boyled in it becomes 'hard and reddish. The Springs rising out of large 'covered spaces (such as are great Cities) yield this 'Water, as having been percolated thorough more 'ground than other Water, and consequently been 'divested of its fatty earthy particles, and more im-'pregnated with saline substances in all the way it 'hath passed. The Dyers use this Water in Reds, and 'in other Colours wanting restringency, and in the 'dying of Materials of the slacker Contextures, as in 'Callico, Fustian, and the several species of Cotton-'works. This Water is naught for Blues, and makes 'Yellows and Greens look rusty.

'River-water is far more fat and oily, sweeter, 'bears Soap; that is, Soap dissolves more easily in it, 'rising into froth and bubbles, so as the Water thick-'ens by it. This Water is used in most cases by Dy-'ers, and must be had in great quantities for washing 'and rinsing their Cloaths after Dying.

'Water is called by Dyers White Liquor; but 'there is another sort of Liquor called Liquor abso-'lutely, and that is their Bran-liquor, which is one 'part of Bran and five of River-water, boyled toge-'ther an hour, and put into leaden Cisterns to settle. 'This Liquor when it turns sour is not good; which 'sourness will be within three or four Days in the 'Summer-time. Besides the uses afore-named of 'this Liquor, I conceive it contributes something to 'the holding of the Colour; for we know Starch, 'which is nothing but the flour of Bran, will make 'a clinging Paste, the which will conglutinate some 'things, though not every thing; *viz.* Paper, though 'neither Wood nor Metals. Now Bran-liquors are 'used to mealy dying Stuffs, such as *Mather* is, being

'the

'the Powder or *fecula* of a Root; ſo as the flour 'of the Bran being joyned with the *Mather*, and 'made clammy and glutinous by boyling, I doubt not 'but both ſticking upon the *villi* of the Stuff dyed, 'the *Mather* ſticks the better by reaſon of the ſtarchy 'paſtineſs of the Bran-flour joyned with it.

'Gums have been uſed by Dyers about Silk, *viz.* 'Gum *Arabick*, Gum *Dragant*, *Maſtick*, and *San-* 'guis *Draconis*. Theſe Gums tend little to the 'tincture of the ſaid Silk, no more than Gum doth 'in ordinary writing Ink, which only gives it a con- 'ſiſtence to ſtay juſt where the Pen delivers it, without 'running abroad uncertainly: So Gum may give the 'Silk a glaſſineſs, that is, may make it ſeem finer, as 'alſo ſtiffer; ſo as to make one believe the ſaid ſtiff- 'neſs proceeded from the quantity of Silk cloſe wo- 'ven: And laſtly, to increaſe weight; for if an 'ounce of Gum, worth a penny, can be incorporated 'into a pound of Silk, the ſaid penny in Gum produ- 'ceth three Shillings, the price of an Ounce of Silk. 'Wherefore we ſhall ſpeak of the uſe of each of the 'ſaid four Gums, rather when treating of Siſing and 'Stiffening, than now in a Diſcourſe of Dying, where 'alſo we may ſpeak of Honey and Molaſſes.

'We refer alſo the Deſcriptions of Fullers-earth, 'Soaps, Linſeed-oyl, and Ox-galls, unto the head of 'Scouring, rather than to this of Dying.

'Wines and *Aqua-vitæ* have been uſed by ſome 'particular Artiſts; but the uſe of them being nei- 'ther conſtant nor certain, I omit further mention 'of them. The like I ſay of Wheaten-flour and 'Leaven.

'Of *Cummin-ſeed*, *Fenugreek-ſeed*, *Senna*, and *Aga-* 'rick, I have as yet no ſatisfactory account.

'Ha-

'Having ſpoken thus far of ſome of the Dying 'ſtuffs, before I engage upon the main, and ſpeak 'more fully of thoſe which have been but ſlightly 'touched upon already, I ſhall more ſynoptically here 'inſert a Catalogue of all Dying Materials, as well 'ſuch as I have already treated upon, as ſuch as I in-'tend hereafter to deſcribe.

'The three peculiar Ingredients for Black are Cop-'peras, filings of Steel, and Slippe.

'The Reſtringent binding Materials are Alder Bark, 'Pomegranet Pills, Wallnut rinds and roots, Oaken 'Sapling Bark, and Saw-duſt of the ſame; Crab-'tree Bark, Galls, and Sumach.

'The Salts of Allum, Argol, Salt-peter, *Sal-Ar-'moniack*, Pot-aſhes, and Stone-Lime, unto which 'Urine may be enumerated as a liquid Salt.

'The Liquors are Well-water, River-water, Wine, '*Aqua-vitæ*, Vinegar, Juyce of Lemon, and *Aqua-'fortis*: There is Honey uſed, and Molaſſes.

'Ingredients of another *Claſſis* are Bran, Wheaten-'flour, Yolks of Eggs, Leaven, Cummin-ſeed, Fe-'nugreek-ſeed, Agarick, and Senna.

'Gums are *Gum Arabick*, *Dragant*, *Maſtick*, and '*Sanguis Draconis*.

'The Smecticks or Abſterſives are Fuller's-earth, 'Soap, Linſeed-oyl, and Ox-gall.

'The other Metals and Minerals are Pewter, Ver-'degreaſe, Antimony, Litharge, and Arſenick.

'But the *Colorantia colorata* are of three ſorts, *viz.* 'Blue, Yellow, and Red; of which Logwood, old 'Fuſtick, and Mather, are the *Polycareſta* in the pre-'ſent and common practices, being one of each ſort. 'The Blues are Woad, Indico and Logwood: The Yel-'lows are Weld, Wood-wax, and old Fuſtick, as alſo

'Tur-

'Turmerick, now ſeldom uſed: The Reds are Red-'wood, Brazil, Mather, Cochineel, Safflowrs, Kermes-'berries, and Sanders; the latter of which is ſeldom 'uſed, and the Kermes not often. Unto theſe *Ar-'notto* and young Fuſtick, making Orange-colours, 'may be added, as often uſed in theſe times.

'In Cloth Dying, wood-ſoot is of good uſe.

'Having preſented this Catalogue, I come now to 'give or enlarge the Deſcription and Application of 'ſome of the chief of them, beginning with Cop-'peras.

'Copperas is the common thing uſed to dye Blacks 'withal, and it is the ſalt of the *Pyrites* ſtone, where-'with old Iron (having been diſſolved in it) is incor-'porated. The filings of Steel, and ſuch ſmall parti-'cles of Edge-tools as are worn away upon the 'Grindſtone, commonly called Slippe, is uſed to the 'ſame purpoſe in Dying of Silks (as we ſaid before) 'which I conceive to be rather to increaſe the weight 'than for any other neceſſity; the particles of Cop-'peras being not ſo heavy and craſs as theſe are: for 'elſe why ſhould not theſe latter-named Materials be 'as well uſed about Cloth, as other cheaper ſtuffs?

'We obſerve, that green Oaken-boards by the affri-'ction of a Saw become black; and that a green ſour 'Apple cut with a knife, becomes likewiſe black; 'and that the white greaſe wherewith Coach-wheels 'are anointed, becomes likewiſe black, by reaſon of 'the Iron boxes wherewith the Nave is lined, beſides 'the uſtulation or affriction between the Nave and the 'Axel-tree. Moreover we obſerve, that an Oaken-'ſtick, by a violent affriction upon other wood in a 'Turning-Lath, makes the ſame black

'From

'From all which we may obſerve, That the whole 'buſineſs of Blacking lies in the Iron, as if the ſalt of 'the *Pyrites*-ſtone in Copperas ſerved only to ex- 'tract the ſame; and withal it ſeems to lie in a kind 'of ſindging and uſtulation, ſuch as rapid affrictions 'do cauſe: For Allum ſeems to be of the ſame na- 'ture with Vitriol; and yet in no caſe that I know 'of, is uſed for black colours: And in the black co- 'lour upon earthen Ware is made with ſcalings of 'Iron vitrified. Note, That where-ever Copperas is 'uſed, either Galls, Sumach, Oak Sapling-barks, Al- 'der-bark, Walnut-rinds, Crabtree-bark, or green Oak 'ſaw-duſt, muſt be uſed with it: All which things 'Phyſicians call Auſtere and Stiptick.

'Red-wood muſt be chopt into ſmall pieces, then 'ground in a Mill between two heavy ſtones, as corn 'is. It is uſed alſo in Dying of Cloth and Rugs, and 'thoſe of the Coarſer ſort: The colour is extracted 'with much and long boyling, and that with Galls. 'The colour it makes is a kind of Brick-colour Red; 'it holdeth much better than Braſil. The Cloth it 'dyeth is to be boyled with it: Wherefore only ſuch 'matters as are not prejudiced by much boyling are 'dyed herewith.

'Braſil is chopt and ground like as the Red-wood: 'It dyeth a Pink-colour or Carnation, imitating the 'colour of Cochineil the neareſt: It is uſed with 'Allum for the ordinary colour it dyeth; and with 'addition of Pot-aſhes, when it is uſed for Purples.

'Braſil ſteept in Water giveth it the colour of Clar- 'ret-wine, into which a drop or two of Juyce of 'Lemons or Vinegar being put, turneth it into the 'colour of Canary-Sack; in which particular it a- 'greeth with Cochineil. This colour ſoon ſtaineth,

'as may appear by the eaſy change which ſo ſmall a 'quantity of acid liquor makes upon it. A drop of 'Spirit of Vitriol turneſt the infuſion of Braſil into a 'purpliſh violet-colour, even although it hath been 'made yellow before, by the addition of Juyce of 'Lemons or Vinegar; and is the ſame effect which 'Pot-aſhes alſo produce, as we ſaid before.

'*Mather* is a Root cultivated much in *Flanders*: 'There be of it two ſorts; *Pipe-Mather*, which is 'the coarſeth; and *Bale-Mather*, otherwiſe called '*Crap-Mather*: This *Mather* uſed to the beſt advan-'tage, dyeth on Cloth a colour the neareſt to our 'Bow-dye, or the new Scarlet; the like whereof 'Safflowr doth in Silk, inſomuch as the colours cal-'led Baſtard-Scarlets are dyed with it. This colour 'indures much boyling, and is uſed both with Allum 'and Argol: it holdeth well. The brighteſt colours 'dyed with this material are made by over-dying the 'ſame, and then by diſcharging part of it by back-'boyling it in Argol.

'*Mather* is uſed with Bran-liquor, inſtead of White-'liquor, or ordinary Water.

'*Cochineil* is of ſeveral ſorts, *viz. Silveſter* and '*Meſtequa*: This alſo is uſed with Bran-liquor in Pew-'ter-Furnaces, and with *Aqua-fortis*, in order to the 'Scarlet dye. It is the colour whereof the like quan-'tity effecteth moſt in Dying; and Colours dyed 'with it, are ſaid to be dyed in Grain. Rags dyed 'in the dregs of this colour is called *Turnſole*, and 'tis 'uſed to colour Wines; *Cochineil* being counted ſo 'far from an unwholeſome thing, that it is eſteemed a 'Cordial. Any acid Liquor takes off the intenſe 'Redneſs of this colour, turning it towards an O-'range, Flame, or Scarlet colour: With this colour

'alſo

'also the *Spanish* Leather and Flocks are dyed which 'Ladies use. The extract or *fecula* hereof makes the 'finest *Lake*.

*Arnotto* dyeth of it self an Orange-colour, is used 'with Pot-ashes upon Silk, Linnen, and Cottons, 'but not upon Cloth, as being not apt to penetrate in-'to a thick substance.

'*Weld*, called in Latin *Luteola*; when it is ripe '(that is to say, in the flower) it dyeth (with the help 'of Pot-ashes) a deep Lemon-colour, like unto *Ra-'nunculus*, or Broom-flower; and either by the small-'ness of proportion put into the Liquor, or else by 'the slighter tincture, it dyeth all Colours between 'White and the Yellow aforesaid.

'In the use of this material, Dyers use a cross, 'driven down into their Furnace, with a screw to 'keep it down, so as the Cloth may have liberty in 'the supernatant Liquor, to be turned upon the 'Winch, and kept out with the staves: This weed is 'much cultivated in *Kent*, for the use of the *Lon-'don* Dyers; it holdeth sufficiently well but against 'Urine and *Tartarous* Liquors. Painters Pinke is 'made of it.

'*Wood-wax*, or *Genista Tinctoria* (commonly cal-'led Grasing-weed by the Dyers) produces the same 'effect with the *Luteola*, being used in greater quan-'tities: It is seldom made use of as to Silk, Linnen, 'or Cottons, but only as to coarse Cloths: It is also 'set with Pot-ashes or Urine, called by the Dyers '*Sigge-fustick*; of it there be two sorts, the *young* and 'the *old*. *Fustick* is chopt and ground as the other 'Woods above-mentioned are.

'The *young Fustick* dyeth a kind of Reddish 'Orange-colour; the *old*, a Hair-colour with several

'degrees of yellowneſs between: It is uſed with 'ſlacked Lime. The colours dyed with *old Fuſtick* 'hold extreamly, and are not to be diſcharged, will 'ſpend *with* Salts or *without*, and will work hot or 'cold.

'*Soot of Wood.* *Soot* containeth in it ſelf both a 'Colour and Salt; wherefore there is nothing added 'to it to extract its Colour, nor to make it ſtrike up-'on the Stuff to be Dyed; the natural Colour which 'it Dyeth of it itſelf, is the Colour of Honey; but 'is the foundation of many other Colours upon 'Wool and Cloth; for to other things it is not uſed. '*Woad* is made of a Weed, ſown upon ſtrong new-'broken Land, perfectly cleared from all ſtones and 'weeds, cut ſeveral times by the top leaves, then 'ground, or rather chopt with a peculiar Mill for 'that purpoſe; which being done ſeveral times, it is 'is made up in Balls and dryed in the Sun; the dryer 'the year is, the better the Woad.

'When it is made up in Balls, it is broken again 'and laid in heaps, where if it heat too faſt, it is 'ſprinkled with ordinary water; but if it heat too 'ſlowly, then they throw on it a quantity of Lime or 'Urine. But of the perfect cultivating and curing of 'Woad, we ſhall ſpeak elſewhere.

'*Engliſh Woad* is counted the ſtrongeſt, it is com-'monly tryed by ſtaining of white Paper with it, or 'a white limed Wall, and if the Colour be a French-'green it is good.

'*Woad* in uſe is uſed with Pot-aſhes commonly 'called Ware, which if it double refin'd, is called 'hard Ware (which is much the ſame with Kelp) or 'Sea-weeds, calcin'd and burnt into the hardneſs of 'a ſtone, by reiterated Calcinations.

*Lime*

'*Lime* or *Calke*, which is ſtrong Lime, is uſed to 'accelerate the fermentation of the *Woad*, which by 'the help of the ſame Pot-aſhes and warm liquors 'kept always ſo, in three or four Days will come to 'work like a Kive of Beer, and will have a blue or 'rather greeniſh froth or flowry upon it, anſwering to 'the Yeſt or the Kive. Now the over quantity of 'Ware, fretting too much upon the Woad, is obtund-'ed or dulled by throwing in Bran ſometimes looſe, 'ſometimes in Bags.

'The making and uſing Woad, is one of the moſt 'myſterious, nice, and hazardous operations in Dy-'ing: It is one of the moſt laſting colours that is 'dyed: An intenſe Woad-Colour is almoſt black, 'that is to ſay, of a Damſon-colour; this Colour is 'the foundation of ſo many others in its degree, that 'the Dyers have a certain Scale, or number of Stalls, 'whereby to compute the lightneſs and deepneſs of 'this Colour.

'*Indico* is made of a Weed of the ſame Nature 'with Woad, but more ſtrong; and whereas Woad 'is the whole ſubſtance of the Herb, Indico is only 'a mealy concrete juice or *fecula* dryed in the Sun, 'ſometimes made up in flat Cakes, ſometimes into 'round Balls; there be ſeveral ſorts of Indico.

'*Logwood* is chopt and ground like other of the 'Woods above-mentioned; it maketh a purpliſh blue; 'may be uſed without Allum: It hath been eſteemed 'a moſt falſe and fading colour; but now being uſed 'with Galls, is far leſs complained of.

*General*

## General Observations upon

# DYING.

'FIRST, that all the materials (which of themselves do give Colour) are either Red, Yellow, or 'Blue, so that out of them, and the primitive fundamental Colour White, all that great variety which 'we see in dyed Stuffs doth arise.

'2. That few of the Colouring materials (as 'Cochineil, Soot, Wood-wax, Woad) are in their 'outward and first appearance of the same Colour, 'which by the slightest distempers and solutions in 'the weakest *Menstrua*, the Dye upon Cloth, Silk, '*&c.*

'3. That many of the Colouring materials will 'not yield their Colours without much grinding, 'steeping, boyling, fermenting, or corrosion by pow-'erful *Menstrua*; as Red-wood, Weld, Woad, Ar-'notto, *&c.*

'4. That many of the said Colouring materials 'will of themselves give no Colouring at all, as Cop-'peras, or Galls, or with much disadvantage, unless 'the Cloth or other Stuff to be dyed, be as it were 'first covered or incrustated with some other matter, 'though Colour-less aforehand, as Mather, Weld, 'Brasil, with Allum.

'5. That some of the said Colouring materials 'by the help of other colour-less ingredients, do 'strike different Colours from what they would 'alone, and of themselves; as Cochineil, Brasil, '*&c.*

'6. That

'6. That some Colours, as Mather, Indico, and 'Woad, by reiterated tinctures, will at last become 'black.

'7. That although Green be the most frequent and 'common of natural Colours, yet there is no simple 'ingredient, which is now used alone, to dye Green 'with upon any Material; *Sap-green* (being the con-'densated juice of the *Rhamnous Berry*) being the 'nearest; the which is used by Country People.

'8. There is no black thing in use which dyes 'black, tho' both the Coal and Soot of most things 'burnt or scorched be of that colour; and the black-'er, by how much the matter before it was burnt 'was whiter, as in the famous instance of *Ivory* '*black*.

'9. The tincture of some Dying Stuffs will fade 'even with lying, or with the Air, or will stain even 'with Water; but very much with Wine, Vinegar, 'Urine, *&c.*

'10. Some of the Dyers Materials are used to bind 'and strengthen a Colour, some to brighten it, some 'to give lustre to the Stuff, some to discharge and take 'off the Colour either in whole or in part, and some 'out of fraud, to make the Material dyed (if costly) 'to be heavier.

'11. That some Dying Ingredients or Drugs, by the 'coarseness of their Bodies, make the thread of the 'dyed Stuff seem coarser; and some by shrinking 'them, smaller, and some by levigating their Asperi-'ties, finer.

'12. Many of the same Colours are dyed upon se-'veral Stuffs with several Materials; as *Red-wood* is 'used in Cloth, not in Silks; *Arnotto* in Silks, not 'in Cloth; and may be dyed at several prices.

'13. That

'13. That Scowering and Washing of Stuffs to be 'dyed, is to be done with special Materials; as some-'times with Ox-galls, sometimes with Fullers-earth, 'sometimes with Soap: This latter being pernicious 'in some cases, where Pot-ashes will stain or alter the 'colour.

'14. Where great quantities of Stuffs are to be 'dyed together, or where they are to be done with 'great speed, and where the pieces are very long, 'broad, thick, or otherwise, they are to be diffe-'rently handled, both in respect to the Vessels and 'Ingredients.

'15. In some Colours and Stuffs the tingent Li-'quor must be boyling; in other cases blood-warm; 'in some it may be cold.

'16. Some tingent Liquors are fitted for use by 'long keeping; and in some the vertue wears away 'by the same.

'17. Some Colours or Stuffs are best dyed by re-'iterated Dippings over into the same Liquor at seve-'ral distances of time; and some by continuing lon-'ger, and others lesser whiles therein.

'18. In some cases the matter of the Vessel where-'in the Liquors are heated, and the Tinctures prepared, 'must be regarded; as the Kettles must be Pewter for 'Bow-dye.

'19. There is little reckoning made how much 'Liquor is used in proportion to the dying Drugs; 'the Liquor being rather adjusted to the bulk of the 'Stuff, as the Vessels are to the breadth of the same: 'The quantity of dying Drugs being proportioned 'to the Colour higher or lower, and to the Stuffs 'both; as likewise the Salts are to dying Drugs.

'Con-

'Concerning the weight which Colours give to 'Silk (for in them 'tis moſt taken notice of, as being 'ſold by weight, and being a Commodity of great 'price) it is obſerved, That one pound of raw Silk 'loſeth four ounces by waſhing out the Gums and 'natural *Sordes*.

'That the ſame ſcowred Silk may be raiſed to 'above thirty ounces from the remaining twelve, if 'it be dyed black with ſome Materials.

'The reaſon why Black colour may be moſt heavy 'dyed, being becauſe all gravitating Drugs may be 'dyed black, being all of colours lighter than it: 'whereas perhaps there are few or no Materials where-'with to increaſe the weight of Silk, which will con-'ſiſt with fair light colours; ſuch as will, having been 'uſed, as white Arſenick to Incarnadives. Of a thing 'truly uſeful in Dying, eſpecially of Blacks, nothing 'increaſes weight ſo much as Galls, by reaſon where-'of black Silks are reſtored to as much weight as they 'loſt by waſhing out their Gum: Nor is it counted ex-'traordinary, that Blacks ſhould gain about four or 'ſix ounces in the Dying upon each pound.

'Next to Galls, old Fuſtick increaſes the weight 'about 1 ½ in 12.

'Mather about one ounce.

'Weld half an ounce.

'The Blue-fat, in deep Blues of the fifth ſtall, 'gives no conſiderable weight.

'Neither doth Logwood, Cochineil, nor Arnotto: 'Nor doth Copperas itſelf, where Galls are not.

'I conceive much light would be given to the 'Philoſophy of Dying, by careful Experiments of the 'weight added by each Drug or Salt in Dying of every 'colour.

'*Slipp* adds much to the weight, and giveth a deeper Black than *Copperas* itſelf; which is a good excuſe 'for the Dyers that uſe it.

'I have hitherto but mentioned the ſeveral Colorations uſed in Humane Affairs, enumerated the ſeveral Materials uſed in one of them, namely, Dying; and imperfectly deſcribed the ſeveral uſes and applications of them in Dying. I have alſo ſet down ſome general Obſervations relating to that whole Trade. It remains now that we deſcribe the ſeveral Veſſels, Tools, and Utenſils uſed in the ſame: And particularly to ſhew how any Colour aſſigned may be ſuperinduced upon any kind of Material, as Wool, Linnen, Hair, Feathers, Cotton or Silk: And with what Advantages or Diſadvantages of Laſting, Brightneſs, Cheapneſs, and Variety, *&c.* each may be performed. But this being infinite, and almoſt unteachable by words, as being incomparably more difficult, than how to imitate and compoſe any Colour aſſigned, out of the few, uſually furniſhing a Painter's Palat; I leave the whole to the further conſideration of this Learned Society.

THE

THE

# HISTORY

Of the Generation and Ordering of

# GREEN OYSTERS,

Commonly called

# Colcheſter-Oyſters.

'IN the Month of *May* the *Oyſters* caſt their Spawn (which the Dredgers call their Spat); it is like 'to a drop of Candle, and about the bigneſs of an 'half-penny.

'The Spat cleaves to Stones, old Oyſter-ſhells, 'pieces of Wood, and ſuch like things, at the bottom 'of the Sea, which they call Cultch.

'Tis probably conjectur'd, that the Spat in twenty 'four hours begins to have a Shell.

'In the Month of *May* the Dredgers (by the Law 'of the Admiralty Court) have liberty to catch all 'manner of *Oyſters*, of what ſize ſoever.

'When they have taken them, with a knife they 'gently raiſe the ſmall brood from the Cultch, and 'then they throw the Cultch in again, to preſerve 'the ground for the future, unleſs they be ſo newly 'Spat that they cannot be ſafely ſevered from the 'Cultch; in that caſe they are permitted to take the 'ſtone or ſhell, *&c.* that the Spat is upon, one ſhell 'having many times twenty Spats.

'After the Month of *May* it is Felony to carry a-
'way the Cultch, and puniſhable to take any other
'*Oyſters*, unleſs it be thoſe of ſize (that is to ſay) a-
'bout the bigneſs of an half Crown piece, or when
'the two ſhells being ſhut, a fair ſhilling will rattle
'between them.

'The places where theſe *Oyſters* are chiefly catch'd,
'are called the *Pont-Burnham*, *Malden*, and *Colne-*
'Waters; the latter taking its name from the River
'of *Colne*, whith paſſeth by *Colne-Cheſter*, gives the
'name to that Town, and runs into a Creek of the
'Sea at a place called the *Hythe*, being the Suburbs
'of the Town.

'This Brood, and other *Oyſters*, they carry to
'Creeks of the Sea at *Brickel-Sea*, *Merſey*, *Langno*,
'*Fringrego*, *Wivenho*, *Tolesbury*, and *Salt-coaſe*, and
'and there throw them into the Channel, which they
'call their Beds or Layers, where they grow and fat-
'ten, and in two or three years the ſmalleſt Brood will
'be *Oyſters* of the ſize aforeſaid.

'Thoſe *Oyſters* which they would have green, they
'put into Pits about three foot deep, in the Salt-
'Marſhes, which are overflowed only at Spring-tides,
'to which they have Sluices, and let out the Salt-
'water until it is about a foot and half deep.

'Theſe Pits from ſome quality in the Soil co-ope-
'rating with the heat of the Sun, will become green,
'and communicate their colour to the *Oyſters* that
'are put into them in four or five days, though they
'commonly let them continue there ſix Weeks, or
'two Months, in which time they will be of a dark
'green.

'To prove that the Sun operates in the greening,
'*Tolesbury* Pits will green only in Summer; but that

'the

'the Earth hath the greater power, *Brickel-Sea* Pits 'green both Winter and Summer: and for a further 'proof, a Pit within a foot of a greening Pit will not 'green; and thoſe that did green very well, will in 'time loſe their quality.

'The *Oyſters* when the Tide comes in, lie with 'their hollow ſhell downwards, and when it goes 'out they turn on the other ſide; they remove not 'from their place unleſs in cold weather, to cover 'themſelves in the Ouſe.

'The reaſon of the ſcarcity of *Oyſters*, and conſe-'quently of their dearneſs, is, becauſe they are of late 'years bought up by the *Dutch*.

'There are great penalties by the Admiralty-Court, 'laid upon thoſe that fiſh out of thoſe grounds which 'the Court appoints, or that deſtroy the Cultch, or 'that take any *Oyſters* that are not of ſize, or that do 'not tread under their feet, or throw upon the ſhore, 'a Fiſh which they call a *Five-finger*, reſembling a 'Spur-rowel, becauſe that fiſh gets into the *Oyſters* 'when they gape, and ſucks them out.

'The reaſon why ſuch a penalty is ſet upon any 'that ſhall deſtroy the Cultch, is becauſe they find 'that if that be taken away, the Ouſe will increaſe, 'and then *Muſcles* and *Cockles* will breed there, and 'deſtroy the *Oyſters*, they having not whereon to 'ſtick their Spat.

'The *Oyſters* are ſick after they have Spat; but in '*June* and *July* they begin to mend, and in *Auguſt* 'they are perfectly well: The *Male-Oyſter* is black-'ſick, having a black Subſtance in the Fin; the *Fe-'male* white-ſick (as they term it) having a milky Sub-'ſtance in the Fin. They are ſalt in the Pits, ſalter 'in the Layers, but ſalteſt at Sea.

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In compoſing *Hiſtories* after this manner, they reſolve to proceed, till they have not only obtain'd an *Account* of all the great and moſt ſubſtantial *Trades*, but alſo of all the leſs *Works*, and Private *Productions*, which are confin'd to ſome particular *Soyls*, or *Corporations*, or *Families*. As this Stock ſhall increaſe, they purpoſe to make it of General uſe, either by continuing *Printing* the moſt remarkable of them, or by freely expoſing them to the view of all, that deſire ſuch *Informations*; provided, that at the ſame time they receive ſome, they will alſo communicate others: And they have aſſured grounds of *confidence*, that when this attempt ſhall be compleated, it will be found to bring innumerable benefits to all practical *Arts:* When all the ſecrets of *Manufactures* ſhall be diſcover'd, their *Materials* deſcrib'd, their *Inſtruments* figur'd, their *Products* repreſented: It will ſoon be determin'd, how far they themſelves may be promoted, and what new conſequences may thence be deduc'd. Hereby we ſhall ſee whether all the parts of the moſt obvious *Crafts* have been brought to perfection; and whether they may not aſſiſt each other, more than has been hitherto endeavour'd: Hereby we ſhall diſcern the compaſs, the power, the changes, the degrees, the ages of them all; and ſpeedily underſtand, whether their effects have been large enough, and the ways of producing them ſufficiently compendious. In ſhort, by this help the worſt *Artificers* will be well inſtructed, by conſidering the *Methods*, and *Tools* of the beſt: And the greateſt *Inventors* will be exceedingly inlighten'd; becauſe they will have in their view the labours of many men, many places, and many times, wherewith to compare their own. This is the ſureſt, and

moſt

moſt effectual means, to inlarge the *Inventions:* whoſe Nature is ſuch, that it is apt to increaſe, not only by mens beholding the *Works* of greater, but of equal, nay of leſs Wits than themſelves.

Sect. XL. *The Concluſion of this Part.*

In the whole progreſs of this *Narration*, I have been cautious to forbear commending the labours of any Private *Fellows* of the *Society*. For this, I need not make any *Apology* to them; ſeeing it would have been an inconſiderable Honour, to be prais'd by ſo mean a Writer: But now I muſt break this *Law*, in the particular caſe of Dr. *Chriſtopher Wren:* For doing ſo, I will not alledge the excuſe of my *Friendſhip* to him; though *that* perhaps were ſufficient; and it might well be allow'd me to take this occaſion of Publiſhing it: But I only do it on the meer conſideration of Juſtice: For in turning over the *Regiſters* of the *Society*, I perceived that many excellent things, whoſe firſt *Invention* ought to be aſcrib'd to him, were caſually omitted: This moves me to do him right by himſelf, and to give this ſeparate Account of his indeavours, in promoting the Deſign of the *Royal Society*, in the ſmall time wherein he has had the opportunity of attending it.

The firſt inſtance I ſhall mention, to which he may lay peculiar claim, is the *Doctrine of Motion*, which is the moſt conſiderable of all others, for eſtabliſhing the firſt *Principles* of *Philoſophy*, by *Geometrical Demonſtrations*. This *Des Cartes* had before begun, having taken up ſome *Experiments* of this kind upon Conjecture, and made them the firſt *Foundation* of his whole *Syſtem* of *Nature:* But ſome of his Concluſions ſeeming very queſtionable, becauſe they were only deriv'd from the groſs Trials of Balls meeting

meeting one another at *Tennis*, and *Billiards*: Dr. *Wren* produc'd before the *Society*, an *Inſtrument* to repreſent the effects of all ſorts of *Impulſes*, made between two hard globous Bodies, either of equal, or of different bigneſs, and ſwiftneſs, following or meeting each other, or the one moving, the other at reſt. From theſe varieties aroſe many unexpected effects; of all which he demonſtrated the true *Theories*, after they had been confirm'd by many hundreds of *Experiments* in that *Inſtrument*. Theſe he propos'd as the Principles of all *Demonſtrations* in *Natural Philoſophy*: Nor can it ſeem ſtrange, that theſe *Elements* ſhould be of ſuch Univerſal uſe; if we conſider that *Generation*, *Corruption*, *Alteration*, and all the Viciſſitudes of *Nature*, are nothing elſe but the effects ariſing from the meeting of little Bodies, of differing Figures, Magnitudes, and Velocities.

The Second *Work* which he has advanc'd, is the *Hiſtory* of *Seaſons*: which will be of admirable benefit to Mankind, if it ſhall be conſtantly purſued, and deriv'd down to Poſterity. His propoſal therefore was, to comprehend a *Diary* of Wind, Weather, and other conditions of the *Air*, as to Heat, Cold, and Weight; and alſo a *General Deſcription* of the Year, whether contagious or healthful to Men or Beaſts; with an Account of *Epidemical Diſeaſes*, of Blaſts, Mill-dews, and other accidents, belonging to Grain, Cattle, Fiſh, Fowl, and Inſects. And becauſe the difficulty of a conſtant *Obſervation* of the *Air*, by Night and Day, ſeem'd invincible, he therefore deviſ'd a *Clock* to be annex'd to a Weather-Cock, which mov'd a Rundle cover'd with Paper, upon which the Clock mov'd a Black-lead-Pencil; ſo that the Obſerver by the Traces of the Pencil on the

the Paper, might certainly conclude, what Winds had blown in his abſence, for twelve hours ſpace: After a like manner he contriv'd a *Thermometer* to be its own *Regiſter*: And becauſe the uſual *Thermometers* were not found to give a true meaſure of the extenſion of the *Air*, by reaſon that the accidental gravity of the liquor, as it lay higher or lower in the Glaſs, weigh unequally on the *Air*, and gave it a farther contraction or extenſion, over and above that which was produc'd by heat and cold; therefore he invented a *Circular Thermometer*, in which the liquor occaſions no fallacy, but remains always in one height moving the whole *Inſtrument*, like a Wheel on its *Axis*.

*He* has contriv'd an *Inſtrument* to meaſure the quantities of *Rain* that falls: This as ſoon as it is full, will pour out itſelf, and at the year's end diſcover how much Rain has fallen on ſuch a ſpace of Land, or other hard ſuperficies, in order to the *Theory* of *Vapours*, *Rivers*, *Seas*, &c.

*He* has devis'd many ſubtil ways for the eaſier finding the gravity of the *Atmoſphere*, the degrees of drought and moiſture, and many of its other accidents. Amongſt theſe *Inſtruments* there are *Balances* which are uſeful to other purpoſes, that ſhew the weight of the *Air* by their ſpontaneous inclination.

Amongſt the new Diſcoveris of the *Pendulum*, theſe are to be attributed to him, that the *Pendulum* in its motion from reſt to reſt; that is, in one deſcent and aſcent, moves unequally in equal times, according to a line of ſines: That it would continue to move either in *Circular*, or *Eliptical* Motions; and ſuch *Vibrations* would have the ſame Periods with thoſe that are reciprocal; and that by a complication

of several *Pendulums* depending one upon another, there might be represented motions like the planetary *Helical Motions*, or more intricate: And yet that these *Pendulums* would discover without confusion (as the *Planets* do) three or four several *Motions*, acting upon one Body with differing *Periods*; and that there may be produc'd a Natural standard for Measure from the *Pendulum* for vulgar use,

*He* has invented many ways to make *Astronomical Observations* more accurate and easy: *He* has fitted and hung *Quadrants*, *Sextants*, and *Radii*, more commodiously than formerly: *He* has made two *Telescopes*, to open with a joynt like a Sector, by which Observers may infallibly take a distance to half minutes, and find no difference in the same Observation reiterated several times; nor can any warping or luxation of the Instrument hinder the truth of it.

*He* has added many sorts of *Retes*, *Screws*, and other devises to *Telescopes*, for taking small distances and apparent Diameters to Seconds. *He* has made apertures to take in more or less light, as the Observer pleases, by opening and shutting like the Pupil of the Eye, the better to fit Glasses to *Crepuscline Observations*: *He* has added much to the Theory of *Dioptrics*; much to the Manufacture it self of grinding good Glasses. *He* has attempted, and not without success, the making of Glasses of other forms than Spherical: *He* has exactly measured and delineated the Spheres of the Humours in the *Eye*, whose proportions one to another were only gues'd at before. This accurate discussion produc'd the Reason, why we see things erected, and that *Reflection* conduces as much to *Vision* as *Refraction*.

*He* discours'd to them a natural and easy *Theory* of *Refraction*, which exactly answer'd every *Experiment*. *He* fully demonstrated all *Dioptrics* in a few Propositions, shewing not only (as in *Kepler's Dioptrics*) the common Properties of Glasses, but the Proportions by which the individual Rays cut the *Axis*, and each other; upon which the Charges (as they are usually called) of *Telescopes*, or the Proportion of the Eye-glasses and *Apertures* are demonstrably discover'd.

*He* has made constant Observations on *Saturn*; and a Theory of that *Planet*, truly answering all *Observations*, before the printed Discourse of *Hugonius* on that Subject appear'd.

*He* has essay'd to make a true *Selenography* by measure; the *World* having nothing yet but Pictures, rather than Surveys and Maps of the *Moon*. *He* has stated the *Theory* of the Moon's Libration, as far as his *Observations* could carry him. *He* has compos'd a *Lunar Globe*, representing not only the Spots, and various degrees of whiteness upon the Surface, but the Hills, Eminencies, and Cavities moulded in solid Work. The Globe thus fashioned into a true Model of the Moon, as you turn it to the Light, represents all the Menstrual phases, with the variety of Appearances that happen from the Shadows of the Mountains and Valleys. *He* has made Maps of the *Pleiades*, and other *Telescopical* Stars; and propos'd Methods to determine the great doubt of the Earth's motion or rest, by the small Stars about the Pole to be seen in large *Telescopes*.

In order to *Navigation he* has carefully pursu'd many *Magnetical Experiments*; of which this is one of the noblest and most fruitful *Speculation*: A large *Terella* is plac'd in the midst of a Plane Board, with a hole

into which the *Terella* is half immers'd, till it be like a *Globe*, with the *Poles* in the *Horizon*. Then is the Plane duſted over with ſteel-filings equally from a Sieve: The Duſt by the *Magnetical* virtue is immediately figur'd into Furrows that bend like a ſort of *Helix*, proceeding as it were out of one *Pole*, and returning into the other: And the whole Plane is thus figur'd like the Circles of a *Planiſphere*.

It being a Queſtion amongſt the Problems of *Navigation*, very well worth reſolving, to what Mechanical powers the Sailing (againſt the wind eſpecially) was reducible; he ſhew'd it to be a Wedge: And he demonſtrated how a tranſient Force upon an oblique Plane, would cauſe the motion of the Plane againſt the firſt Mover. And he made an *Inſtrument*, that *Mechanically* produc'd the ſame effect, and ſhew'd the reaſon of Sailing to all Winds.

The *Geometrical Mechanics* of *Rowing*, he ſhew'd to be a *Vectis* on a moving or cedent *Fulcrum*. For this end he made *Inſtruments*, to find what the expanſion of Body was towards the hindrance of Motion in a Liquid *Medium*; and what degree of impediment was produc'd, by what degree of expanſion: With other things that are the neceſſary Elements for laying down the *Geometry* of *Sailing*, *Swimming*, *Rowing*, *Flying*, and the Fabricks of *Ships*.

*He* has invented a very curious and exceeding ſpeedy way of *Etching*. *He* has ſtarted ſeveral things towards the emendation of *Water-works*. *He* has made *Inſtruments* of *Reſpiration*, and for ſtraining the breath from fuliginous vapours, to try whether the ſame breath ſo purify'd will ſerve again.

*He* was the firſt *Inventer* of drawing Pictures by *Microſcopical Glaſſes*. *He* has found out perpetual, at leaſt

leaſt long-liv'd Lamps, and Regiſters of Furnaces, and the like, for keeping a perpetual Temper, in order to various uſes; as hatching of Eggs, Inſects, production of Plants, Chymical Preparations, imitating Nature in producing Foſſils and Minerals, keeping the Motion of Watches equal, in order to *Longitudes* and *Aſtronomical uſes*, and infinite other advantages.

*He* was the firſt Author of the Noble *Anatomical Experiment* of *Injecting Liquors into the Veins of Animals:* An *Experiment* now vulgarly known; but long ſince exhibited to the Meetings at *Oxford*, and thence carried by ſome *Germans*, and publiſh'd abroad. By this *Operation* divers Creatures were immediately purg'd, vomited, intoxicated, kill'd, or reviv'd, according to the quality of the Liquor injected. Hence aroſe many new *Experiments*, and chiefly that of *Transfuſing Blood*, which the *Society* has proſecuted in ſundry Inſtances, that will probably end in extraordinary Succeſs.

This is a ſhort account of the principal *Diſcoveries* which Dr. *Wren* has preſented or ſuggeſted to this *Aſſembly*. I know very well, that ſome of them *he* did only ſtart and deſign; and that they have been ſince carry'd on to perfection, by the induſtry of other hands. I purpoſe not to rob them of their ſhare in the honour: Yet it is reaſonable, that the original *Invention* ſhould be aſcrib'd to the true *Author*, rather than the *Finiſhers*. Nor do I fear that this will be thought too much, which I have ſaid concerning him: For there is a peculiar reverence due to ſo much excellence, cover'd with ſo much modeſty. And it is not Flattery but Honeſty, to give him his juſt praiſe; who is ſo far from uſurping the fame of other men,

that

that he endeavours with all care to conceal his own.

I have now performed my *Promiſe*, and drawn out of the Papers of the *Society*, an *Epitome* of the chief *Works* they have conceiv'd in their Minds, or reduc'd into Practice. If any ſhall yet think they have not uſefully employ'd their time, I ſhall be apt to ſuſpect, that they underſtand not what is meant by a *diligent* and *profitable labouring* about *Nature*. There are indeed ſome men who will ſtill condemn them for being idle, unleſs they immediately profeſs to have found out the Squaring the Circle, or the *Philoſophers Stone*, or ſome other ſuch mighty *Nothings*. But if theſe are not ſatisfied with what the *Society* has done, they are only to blame the extravagance of their own Expectations. I confeſs, I cannot boaſt of ſuch pompous *Diſcoveries*: They promiſe no Wonders, nor endeavour after them: Their Progreſs has been equal, and firm, by natural degrees, and thorough ſmall things, as well as great: They go leiſurably on; but their ſlowneſs is not caus'd by their idleneſs, but care. They have contriv'd in their thoughts, and courageouſly begun an *Attempt*, which all *Ages* had deſpair'd of. It is therefore fit that they alone, and not others, who refuſe to partake of their burden, ſhould be Judges by what ſteps, and what pace, they ought to proceed.

Such men are then to be intreated not to interrupt their *Labours* with impertinent rebukes; they are to remember, that the *Subject* of their *Studies* is as large as the *Univerſe*: and that in ſo vaſt an *Enterpriſe*, many intervals and diſappointments muſt be reckon'd upon. Though they do not behold that the *Society* has already fill'd the world with *perfect Sciences*;

yet

yet they are to be inform'd, that the nature of their *Work* requir'd that they ſhould firſt begin with *immethodical Collections* and *indigeſted Experiments*, before they go on to finiſh and compoſe them into *Arts*. In which Method they may well be juſtified, ſeeing they have the *Almighty Creator* himſelf for an *Example:* For he at firſt produc'd a confus'd and ſcatter'd Light; and reſerv'd it to be the *Work* of another day, to gather and faſhion it into beautiful *Bodies*,

*The End of the Second Part.*

# THE HISTORY OF THE *ROYAL SOCIETY.*

## *The* THIRD PART.

THOUGH it be certain, that the promoting of *Experiments* according to this *Idea*, cannot injure the Virtue, or Wisdom of men's minds, or their former *Arts*, and mechanical Practices, or their establish'd ways of life; yet the perfect innocence of this design, has not been able to free it from the cavil of the *Idle*, and the *Malicious*; nor from the jealousies of private Interests. These groundless prejudices of the particular *Professions*, and *Ranks* of Men, I am now in the last Place to remove; and to shew that there is no Foundation for them: To suspect the *Change*, which can be made by this *Institution*, or the new things it is likely to produce.

Sect. I. *The Subject and Division of this Third Part.*

That it will probably be the Original of many *new things*, I am so far from denying, that I chearfully acknowledge it. Nor am I frighted at that, which is wont to be objected in this Case, the hazard of *Alteration*, and *Novelty*. For if all things that are

*new* be *deſtructive*, all the ſeveral means, and degrees, by which Mankind has riſen to this perfection of *Arts*, were to be condemn'd. If to be the *Author* of *new things*, be a crime; how will the firſt Civilizers of *Men*, and Makers of *Laws*, and Founders of *Governments* eſcape? Whatever now delights us in the Works of *Nature*, that excels the rudeneſs of the firſt Creation, is *New*. Whatever we ſee in Cities, or Houſes, above the firſt wildneſs of Fields, and meaneſs of Cottages, and nakedneſs of Men, had its time, when this imputation of *Novelty* might as well have been laid to its charge. It is not therefore an offence, to profeſs the introduction of *New things*, unleſs that which is introduc'd prove pernicious in it ſelf; or cannot be brought in, without the extirpation of others, that are better.

And the *Experimental Knowledge*, will not expoſe us to theſe dangers, I am next to declare, in a univerſal *Apology* for its intentions, and effects. This was the Third Portion, which I at firſt reſerv'd, for the Concluſion of my Diſcourſe. Yet caſting my eyes back, I find, that I have already on ſeveral occaſions prevented myſelf; and ſaid many things as I came along, which would have been more proper for this place. But I deſire that my Reader would interpret this to have proceeded from the Nature of my Subject, of which it is hard to write a plain *Hiſtory*, without falling ſometimes unawares into its *Praiſe*. And now I will proceed to a fuller, and more ſolemn *Defence*: In which, I will try to prove, that the increaſe of *Experiments* will be ſo far from hurting, that it will be many ways advantageous, above other *Studies*, to the wonted Courſes of *Education*; to the Principles, and Inſtruction of the minds of

Men in general; to the *Christian Religion*; to the Church of *England*; to all Manual *Trades*; to *Physic*; to the *Nobility*, and *Gentry*; and the universal Interest of the whole *Kingdom*.]

In all which *Particulars*, I hope I shall represent this *Model* to be inoffensive to all the various ways of living, already in use: And thereby I shall secure all the ancient *Proprietors* in their *Rights*: A work as necessary to be done, in raising a new *Philosophy*, as we see it is in building a *new London*.

Sect. II. *Experiments will not injure Education.*

The first Prejudice I am to wipe away, concerns the usual ways of *Education*. For it is an obvious doubt, whether so great a change in *Works*, and *Opinions*, may not have some fatal consequence, on all the former Methods of *Teaching*, which have been long settled, and approv'd by much Custom. And here many good Men of severe, and ancient manners, may seem to have reason, when they urge against us; that the Courses of Training up of Youth, ought to be still the same; that if they be subverted, or multiply'd, much confusion will follow; and that this our *universal Inquiry* into things hitherto unquestion'd, can never be made, without disturbing such establish'd *Rules* of *Discipline*, and *Instruction*.

For a *General Answer* to this, it might suffice to declare, that in this *Institution*, Men are not ingag'd in these *Studies*, till the Course of *Education* be fully compleated: That the *Art* of *Experiments* is not thrust into the hands of Boys, or set up to be perform'd by Beginners in the School; but in an Assembly of Men of Ripe years: Who while they begin a *new Method* of Knowledge, which shall consist of *Works*, and is therefore most proper for Men:

They ſtill leave to Learners, and Children, the old talkative *Arts* which beſt fit the younger Age. From hence it muſt follow, that all the various manners of *Education*, will remain undiſturb'd; becauſe the practices of them, and the labours of this, are not appointed to meet in the ſame *Age*, or *Perſons*. But if this will not ſatisfy our *Adverſaries*, let us proceed to conſider the different Parts of *Education:* and then we ſhall be able to make the ſurer Conjectures, what manner of Influence *new Experiments* will have upon it.

*Education* conſiſts in divers Rules, and Practices, whereby men are furniſh'd for all the ſeveral Courſes of Life, to which they may apply themſelves. Of theſe preparatory *Arts*, ſome concern the *Body*, ſome the *Mind*. Thoſe of the *Body* have no relation to my preſent *Argument:* Of thoſe of the *Mind*, ſome intend the Purity and Ornament of *Speech:* Some the Knowledge of the Actions of former, and preſent *Times:* Some the Government and Virtue of our Lives: Some the *Method* of Reaſoning: Some the Skill in the motions and meaſures of the *Heavens*, and the *Earth*, and all this great Frame of *Viſible* things.

*Grammar, and Rhetoric.*

Firſt then I will make no ſcruple to acquit *Experimental Philoſophy*, from having any ill effects on the uſual *Arts*, whereby we are taught the Purity, and Elegance of *Languages*. Whatever Diſcoveries ſhall appear to us afreſh, out of the hidden things of *Nature*, the ſame words, and the ſame ways of Expreſſion will remain. Or if, perhaps, by this means, any change ſhall be made herein; it can be only for the better; by ſupplying mens Tongues with very many *new things*, to be nam'd, and adorn'd, and deſcrib'd in their diſcourſe.

Nor

Nor can there be any more jealousy concerning the *Moral*, and *Political* Rules of ordering mens lives: But they may still have the same influence, and authority, and may be propos'd to our imitation, by the same precepts and arguments of persuasion. *Moral Philosophy.*

It is also as manifest, that the *Art* of teaching the *Actions* of former Ages, can from hence receive no damage, or alteration. This cannot be otherwise; seeing the Subjects of *Natural* and *Civil History* do not cross each other; nor does the *New Philosophy* of Nature, more interfere with the *Histories* of *Men* and *Government*, than the *Old*, of which this doubt was never rais'd. *History.*

Thus far then we are secure. These great, and fundamental Parts of *Education*, the Instruments of mens Expressing, and Ruling their own minds, and Searching into the Actions of others, will be unalter'd, whatever new changes of Opinions may arise about *Natural Things*. Let us next go on to consider the *Arts* of *Demonstration*, and *Argumentation*, in which consists one of the most weighty Parts of youthful Studies.

First for all the *Mathematical Sciences*, they will still remain the same, and still continue to be learn'd, and taught, in the same *Systems*, and *Methods* as before. Nothing that can now be discover'd will subvert, but rather confirm what is already well built on those immoveable principles. As they came down to us without detriment, through all the corrupt Times of *Learning*; so they will certainly now continue *uncorrupt*, at this present, when *Learning* is restor'd. *The Mathematics.*

Seeing

Seeing they could not be deſtroy'd in the *Ignorant Ages*, they will be in no fear, at this time, by this *Inſtitution*, which deſigns not only to inlarge them, but to promote the ſame rigid way of *Concluſion*, in all other *Natural things*, which only the *Mathematics* have hitherto maintain'd.

*Metaphyſics and Logic.*

Now then, this whole controverſy is reduc'd to the alteration, which the *Logic*, and *Phyſics* of the Ancients, may receive by this change. As for their *Metaphyſics*, they ſcarce deſerve to have a place allow'd them in this conſideration.

Nor does that prevail with me, which the Lovers of that *Cloudy Knowledge* are wont to boaſt, that it is an excellent inſtrument to refine, and make ſubtil the minds of men. For there may be a greater Exceſs in the ſubtilty of mens wits, than in their thickneſs: As we ſee thoſe threads, which are of too fine a ſpinning, are found to be more uſeleſs, than thoſe which are home-ſpun, and groſs.

*Logic* is the *Art* of *Conceiving*, *Arguing*, and *Method*. And notwithſtanding all the progreſs which may happen in *Natural Knowledge*, all the ſeveral parts of Reaſoning, which it teaches in all manner of buſineſs, will continue the ſame: The operations, and power of the *Mind* will ſtill be the ſame: They will ſtill be ſubject to the ſame errors: They will ſtill uſe the ſame degrees of Arguing from particular things, to *Propoſitions* and *Concluſions*; and therefore they will ſtill require the ſame means, and exerciſes for *direction*. It is not the complaint of the promoters of *Experiments*, that men have been wanting to themſelves, in regulating, diſpoſing, or judging of their own *thoughts*. Nay, they rather condemn them, for being wholly im-

imploy'd about the *productions* of their own *Minds*, and neglecting all the works of *Nature*, that are without them. It cannot therefore be ſuſpected that theſe *Inquiſitive Men*, ſhould buſy themſelves about altering the *Art of Diſcourſe*, wherein they judge that mankind has been already rather too curious than negligent.

The laſt Part that I ſhall mention, of the *Learning* that is taught, is the *Syſtem* of *Natural Philoſophy*. And it is in this alone, that I can allow, there will be any alteration made, by this reformation of *Knowledge*. But yet the change will be ſo advantageous, that I have no reaſon to diſſemble it. I grant indeed that the greateſt part of the former Body of *Phyſics*, may hereby chance to fall to the ground. But to what ſum will the damage amount? What can we loſe, but only ſome few *definitions* and idle *queſtions*, and empty *diſputations*? Of which I may ſay, as one did of *Metaphors*, *Poterimus vivere ſine illis*. Perhaps there will be no more uſe of Twenty, or Thirty obſcure Terms, ſuch as *Matter*, and *Form*, *Privation*, *Entelichia*, and the like. But to ſupply their want, an infinite variety of *Inventions*, *Motions*, and *Operations*, will ſucceed in the place of words. The beautiful Boſom of *Nature* will be expos'd to our view: We ſhall enter into its *Garden*, and taſte of its *Fruits*, and ſatisfy our ſelves with its *plenty*: Inſtead of idle talking, and wandring under its fruitleſs ſhadows, as the *Peripetetics* did in their firſt inſtitution, and their Succeſſors have done ever ſince. *Natural Philoſophy.*

Thus

Sect. III. *Experiments not dangerous to the Universities.*

Thus far I have briefly examined the influence of *new Experiments*, or all the chief Parts of *Education*. And after all the *Innovation*, of which they can be suspected, we find nothing will be indanger'd, but only the *Physics* of *Antiquity*: wherein we also behold, that many things of greater concernment, will arise, to supply the place of what shall be cut away. By this discourse, I hope, I have said enough, to manifest the innocence of this *Design* in respect of all the present *Schools of Learning*; and especially our own *Universities*. And it was but just, that we should have this *tenderness*, for the interest of those magnificent *Seats* of *humane Knowledge*, and *divine*, to which the *Natural Philosophy* of our Nation, cannot be injurious without horrible *ingratitude*; seeing in them it has been principally cherish'd, and reviv'd. From hence the greatest part of out *Modern Inventions* have deduc'd their *Original*. It is true, such *Experimental Studies* are largely dispers'd at this time: But they first came forth thence, as the *Colonies* of old did from *Rome*: and therefore as those did, they should rather intend the strength, than the destruction of their *Mother Cities*.

I confess there have not been wanting some forward *Asserters* of *new Philosophy*, who have not us'd any kind of *Moderation* towards them: But have presently concluded, that nothing can be well done in *new Discoveries*, unless all the *ancient Arts* be first rejected, and their Nurseries abolish'd. But the rashness of these mens proceedings, has rather prejudic'd, than advanc'd, what they make shew to promote. They have come as furiously to the purging of *Philosophy*, as our *Modern Zealots* did to the *Refor-*

*Reformation* of *Religion*. And the one Party is as justly to be condemn'd, as the other. Nothing will suffice either of them, but an utter *Destruction*, *Root* and *Branch*, of whatever has the face of *Antiquity*. But as the *Universities* have withstood the fierceness of the one's Zeal without Knowledge; so there is no doubt, but they will also prevail against the Violence of the other's pretences to *Knowledge* without *Prudence*.

Sect. IV. *The Advantage of an Experimental Education.*

But now after I have shewn that all the receiv'd Forms of *Education* will be safe, I shall make no Scruple to add my *Conjecture*, that it could be no hindrance to the *minds* of Men, if besides those courses of Studies which are now follow'd, there were also trial made of some other more practical Ways, to prepare their *Minds* for the World, and the Businesses of human Life. It is not enough to urge against this, that the multiplicity of *Methods* would hinder and confound the Spirits of young Men; for it is apparent that nothing more suppresses the *Genius* of *Learners*, than the *Formality*, and the *Confinement* of the Precepts, by which they are instructed. To this purpose I will venture to propose to the *Consideration* of wise Men, whether this way of *Teaching* by *Practice* and *Experiments*, would not at least be as beneficial, as the other by *Universal Rules*: Whether it were not as profitable to apply the Eyes, and the Hands of Children, to see, and to touch all the several kinds of *sensible Things*, as to oblige them to learn, and remember the difficult *Doctrines* of general *Arts*? In a word, Whether a *Mechanical Education* would not excel the *Methodical*?

This certainly is no new Device: For it was that which *Plato* intended, when he enjoin'd his *Scholars* to begin with *Geometry*; whereby, without queſtion, he deſign'd, that his *Diſciples* ſhould firſt handle *Material Things*, and grow familiar to viſible Objects, before they enter'd on the retir'd *Speculations* of other more abſtracted *Sciences*.

According to this Counſel of the *Father* of *Philoſophers*, it would not be amiſs, if before young Scholars be far engag'd in the beaten Tracks of the Schools, the Myſteries of *Manual Arts*, the Names of their *Inſtruments*, the Secrets of their *Operations*, the Effects of Natural Cauſes, the ſeveral kinds of *Beaſts*, of *Birds*, of *Fiſhes*, of *Plants*, of *Stones*, of *Minerals*, of *Earths*, of *Waters*, and all their common Virtues and Qualities, were propoſed to be the Subjects of their firſt Thoughts and Obſervations. It may be here ſuggeſted, That the vaſt Number of ſuch Particulars will ſoon overwhelm their tender Minds, before they are well eſtabliſh'd by Time, and Uſe. But on the contrary it is evident, that the *Memories* of *Youth* are fitter to retain ſuch ſenſible Images, than thoſe of a fuller Age. It is *Memory* that has moſt Vigour in Children, and *Judgment* in Men: Which if rightly conſider'd, will confirm what I ſaid, that perhaps we take a prepoſterous Courſe in *Education*, by teaching *General Rules*, before *Particular Things*: And that therein we have not a ſufficient Regard to the different Advantages of *Youth* and *Manhood*. We load the Minds of Children with Doctrines, and Precepts, to apprehend which they are moſt unfit, by reaſon of the weakneſs of their Underſtandings; whereas they might with more Profit be exercis'd in the Conſideration of *viſible* and *ſenſible Things*; of whoſe Impreſſions they

they are moſt capable, becauſe of the Strength of their *Memories*, and the Perfection of their *Senſes*.

Sect. V. *The Uſe of Experiments to a practical Life.*

The firſt Years of Men being thus freed from any Apprehenſions of Miſchief by new *Experiments*: I will now proceed more boldly to bring them in amidſt the Throngs, and Crowds of humane Buſineſs; and to declare to all Profeſſions, and practical Lives, that they can receive no ill Impreſſions from them, but that they will be the moſt beneficial and proper *Studies*, for their Preparation and Direction. And to this Purpoſe, I will treat of their uſefulneſs, both in reſpect of Mens public Practice, and the private Government of their own Minds.

*Experiments free from the faults of other ſorts of Learning.*

As to the firſt, it has been an old Complaint, that has been long manag'd by Men of Buſineſs, againſt many ſorts of *Knowledge*, that our Thoughts are thereby infected with ſuch Conceptions as make them more unfit for Action, than they would have been, if they were wholly left to the force of their own *Nature*. The common Accuſations againſt *Learning* are ſuch as theſe; That it inclines Men to be unſettled, and *contentious*; That it takes up more of their Time, than Men of Buſineſs ought to beſtow; That it makes them *Romantic*, and ſubject to frame more perfect Images of Things, than the Things themſelves will bear; That it renders them overweening, unchangeable, and obſtinate; That thereby Men become averſe from a practical Courſe, and unable to bear the Difficulties of Action; That it employs them about Things, which are no where in uſe in the World; and, that it draws them to neglect and contemn their own preſent Times, by doting on the paſt. But now I will maintain, that in every one of theſe Dangers *Experimental Know-*

*ledge* is less to be suspected than any other; That in most of them (if not all) it is absolutely innocent; nay, That it contains the best Remedies for the Distempers, which some other sorts of Learning are thought to bring with them.

Sect. VI. *The first Objection against Learning, That it makes Men too Disputative.*

The first *Objection* against *Knowledge*, of which I shall take notice in the active part of Life, is this, That it makes Men too plentiful in their *Thoughts*; too inventive, and cavilling in their *Arguments*; and so rather teaches them to be witty in *Objecting*, than ready in *Resolving*, and diligent in *Performing*. I confess the Ancient *Philosophy* will hardly be able to vindicate it self from this Charge: For its chief Purpose is to enlarge the Fancy, and to fill the Head with the Matter and Artifice of Discourse. But this cannot any way touch the *Art* of *Experiments*: That consists not in *Topics* of Reasoning, but of Working: That indeed is full of doubting and inquiry, and will scarce be brought to settle its Assent; but it is such a doubting as proceeds on *Trials*, and not on *Arguments*: That does neither practise nor cherish this humour of Disputing, which breaks the force of Things by the subtilty of Words; as *Seneca* was said to do by his Style: It weakens Mens Arms, and slackens all the Sinews of Action: For so it commonly happens, that such earnest Disputers evaporate all the strength of their Minds in arguing, questioning, and debating; and tire themselves out before they come to the *Practice*.

Sect. VII. *The second, That it takes up too much time.*

The next Accusation is, That so many intricate Paths, and spacious Windings of *Learning*, will require more time than can be spar'd by Men of active and busy

busy Lives. The Belief of this has always made a wide Divorce between Men of *Knowledge* and *Action*; while both have thought, that they must either be wholly *Scholars*, or wholly Men of *Business*; and that an Excellence in both these Courses, can never be obtain'd by human Wit. 'Tis true indeed, there is no *Knowledge* or *Science* that can be acquitted from being too large, if their *Professors* have not the Discretion to know how far to proceed, and what Moderation is to be us'd in every *Study*. There is in the least *Art* enough Matter, about which if Men shall resolve to trouble their Brains all their Lives, one *Question* and *Difficulty* will perpetually beget another, and so (as one of the *Ancients* says) *Ipsa tractatio, & quæstio quotidiè ex se gignet aliquid, quod cum desidiosâ delectatione vestiges.*

To this Danger perhaps *Experiments* may seem most expos'd, by reason of the infinite multitude of particulars, and innumerable variations of Inquiries, that may be made. But the *Royal Society* has prevented this Mischief, by the Number and Succession of those that shall undertake the *Work*. They require not the whole time of any of their *Members*, except only of their *Curators*: From the rest they expect no more but what their *Business*, nay even their very *Recreations* can spare. It is the Continuance and Perpetuity of such *Philosophical Labours*, to which they principally trust; which will both allow a sufficient Relaxation to all the particular *Labourers*, and will also give good assurance of the happy Issue of their *Work* at the last: For though that be true, which the Great Physician laments, *That Art is long, and Life is short*; yet many Lives of studious and industrious Men in one *Age*, and the Succession of many Lives of such Men in all future

future *Ages*, will undoubtedly prove as long as *Art* it ſelf.

Sect. VIII. *The third Objection, That it makes our Minds Romantic.*

They farther object againſt *Learning*, That it makes our Minds too *Lofty* and *Romantic*, and inclines them to form more perfect Imaginations of the Matters we are to practiſe than the Matters themſelves will bear. I cannot deny but a meer contemplative Man is obnoxious to this Error: He converſes chiefly in his Cloſet, with the Heads and Notions of Things, and ſo diſcerns not their Bottoms near and diſtinctly enough: And thence he is ſubject to overlook the little Circumſtances, on which all human Actions depend. He is ſtill reducing all Things to ſtanding *Doctrines*; and therefore muſt needs be liable to neglect the Opportunities, to ſet upon Buſineſs too ſoon, or too late; to put thoſe Things together in his Mind, which have no agreement in *Nature*. But this above all is his greateſt Danger, that thinking it ſtill becomes him to go out of the *ordinary Way*, and to refine and heighten the Conceptions of the Vulgar, he will be ready to diſdain all the *natural* and *eaſy* ways of *Practice*, and to believe that nothing ought to be done, though never ſo common, but by ſome device of *Art*, and trick of unuſual *Wiſdom*.

From theſe Inconveniencies the *Experimenter* is ſecure: He invents not what he does out of himſelf; but gathers it from the Footſteps and Progreſs of *Nature*. He looks on every Thing ſtanding equal to it, and not as from a higher Ground: He labours about the plain and undigeſted Objects of his Senſes, without conſidering them as they are joyn'd into common *Notions*. He has an Opportunity of underſtanding the moſt natural Ways by which all Things are produc'd.

duc'd. He clearly beholds all the ſecret Accidents and Turnings, Advantages and Failings of *Nature*. He endeavours rather to know, than to admire; and looks upon *Admiration*, not as the End, but the Imperfection of our *Knowledge*.

Sect. IX. *The fourth Objection, That it makes Men preſumptuous and obſtinate.*

The next hindrance of *Action*, is *an obſtinacy of Reſolution*, and a want of *Dexterity* to change our apprehenſions of Things according to Occaſions. This is the more deſtructive, becauſe it carries with it the moſt ſolemn appearance of *Wiſdom*. There is ſcarce any thing that renders a Man ſo uſeleſs, as a perverſe ſticking to the ſame things in *all times*, becauſe he has ſometimes found them to have been in Seaſon. But now in this, there is ſcarce any *Compariſon* to be made, between him who is only a *thinking Man*, and a *Man of Experience*. The firſt does commonly eſtabliſh his conſtant Rules, by which he will be guided: The later makes none of his *Opinions* irrevocable. The one, if he miſtakes, receives his Errors from his *Underſtanding*; the other only from his *Senſes*; and ſo he may correct, and alter them with more eaſe. The one fixes his *Opinion* as ſoon; the other doubts as long as he can. The one chiefly ſtrives to be unmovable in his Mind; the other to enlarge, and amend his *Knowledge*: And from hence the one is inclin'd to be *preſumptuous*, the other modeſt in his *Judgment*.

Sect. X. *The fifth Objection, That 'tis Pleaſure draws Men off from Buſineſs.*

The next Pretence, on which Men of *Learning* are wont to be vilified, is, that they uſe to be ſo much affected with the pleaſant Muſings of their own Thoughts, as to abhor the Roughneſs, and Toyl of *Buſineſs*. This Accuſation, I confeſs, is not altogether groundleſs. The ſolitary Imaginations of *Speculative*

*culative Men* are of all other the moſt eaſy: There a Man meets with little ſtubbornneſs of Matter: He may chooſe his Subject where he likes; he may faſhion and turn it as he pleaſes: Whereas when he comes abroad into the World, he muſt endure more *Contradiction:* More *Difficulties* are to be overcome; and he cannot always follow his own *Genius:* So that it is not to be wonder'd, that ſo many *great Wits* have diſpis'd the labour of a practical Courſe; and have rather choſen to ſhut themſelves up from the *Noiſe* and *Preferments* of the *World,* to converſe in the Shadow with the pleaſant *Productions* of their own *Fancies.*

And this perhaps is the reaſon why the moſt *extraordinary Men* of *Arts* in all Ages, are generally obſerv'd to be the greateſt *Humouriſts:* They are ſo full of the ſweetneſs of their own *Conceptions,* that they become Moroſe, when they are drawn from them, they cannot eaſily make their Minds ductil and pliable to others Tempers, and ſo they appear untractable, and unskilful in *Converſation.*

From this I ſhall alſo free the *Experimental Philoſopher.* The Satisfaction that he finds, is not *imaginary,* but *real:* It is drawn from Things that are not out of the World, but in it: It does not carry him farther off, but brings him nearer to *Practice.* 'Tis true, that *Knowledge* which is only founded on Thoughts and Words, has ſeldom any other end, but the *breeding* and *increaſing* of more Thoughts and Words: But that which is built on *Works* (as his will be) will naturally deſire to diſcover, to augment, to apply, to communicate it ſelf by more *Works.*

Nor can it be thought, that his *Mind* will be made to languiſh by this pleaſure of *Obſervation,* and to have any Averſion from the difficulty and tediouſneſs of

of human Affairs; seeing his way of *Observation* it self is so *laborious*. It is a good Precept, which is wont to be given in respect of all sorts of *Exercises*, that they should be at least as hard and toilsome, as that *Art* which we strive to gain by them. And by this Rule *Experiments* are an excellent preparation towards any habit or faculty of Life whatsoever. For what Thing, which can be effected by *mortal Industry*, can seem impossible to him who has been ingag'd in these *Studies*, which require such an indefatigable Watchfulness? What can overcome his Diligence, who has been able to sustain with Patience the *Escapes*, the *Delays*, the *Labyrinths* of *Nature*; whom the Repetition of so many *Labours*, so many Failings, with which he meets, and so long attendance could not tire?

Sect. XI. *The sixth Objection, That it makes Men regard the Times past, and neglect the present.*

ANOTHER principal Mischief to be avoided, is the Conformity of our *Actions* to Times past, and not the present. This Extravagance is generally imputed to *studious* Men; and they cannot be wholly acquitted from it. For while they continue heaping up in their *Memories* the Customs of past *Ages*, they fall insensibly to imitate them, without any manner of Care *how* suitable they are to *Times* and *Things*. The Grounds of this Mistake will be worth our discovering, because in Mens Opinions it does so much Prejudice to the Learned part of the *World*. In the ancient *Authors* which they turn over, they find Descriptions of Vertues more perfect then indeed they were: The *Governments* are represented better, and the Ways of Life pleasanter than they deserv'd. Upon this, these *Bookish* wise Men strait compare what they read with what they see: And here beholding nothing so heroically transcendent, because they are able to mark all

the *Spots*, as well as *Beauties* of every Thing, that is so close to their Sight, they presently begin to dispise their own *Times*, to exalt the past, to contemn the *Virtues*, and aggravate the *Vices* of their *Country*; not endeavouring to amend them, but by such Examples as are now unpracticable, by reason of the Alteration of *Men* and *Manners*.

For this Defect, *Experiments* are a soveraign Cure: They give us a perfect Sight of what is before us; they bring us home to our selves; they make us live in *England*, and not in *Athens* or *Sparta*, at this present time, and not three thousand Years ago: Though they permit us to reflect on what has been done in *former Ages*; yet they make us chiefly to regard and contemplate the Things that are in our *View*. This certainly is conformable to the *Design* of *Nature* it self; which though it has fram'd our Bodies in that manner, that we may easily upon occasion turn about to look behind us; yet it has plac'd the *Eyes*, the chief *Instruments* of *Observation*, not in our *Backs*, but in our *Foreheads*.

Sect. XII. *The seventh Objection, That it hinders Use.*

THE last Failing which is wont to be imputed to *Learned Men*, is want of *Use*, and fear of *Practice*, and a conversing with Things in their *Studies*, which they meet with no where else. It may now perhaps be thought that an *Experimenter* is as inclinable to these Weaknesses, as he that only contemplates; because they both keep out of the way, in the Shadow; the one in his *Library*, *arguing*, *objecting*, *defending*, *concluding* with himself; the other in his *Workhouse*, with such Tools and Materials, whereof many perhaps are not publickly in use. Let us then consider which of them is most to be blam'd for conversing with Matters unlike

like thoſe that we meet with in *Civil Affairs?* And which moſt abounds with *Fears* and *Doubts*, and miſtaken in Ideas of *Things*.

It cannot be denied, but the Men of *Reading* do very much buſy themſelves about ſuch *Conceptions*, which are no where to be found out of their own Chambers. The *Senſe*, the *Cuſtom*, the *Practice*, the *Judgment* of the World, is quite a different Thing from what they imagine it to be in private. And therefore it is no wonder, if when they come abroad into Buſineſs, the ſight of Men, the Tumult and Noiſe of Cities, and the very brightneſs of Day it ſelf affright them: Like that *Rhetorician*, who having been us'd to declaim in the ſhade of a *School*, when he came to plead a true Cauſe in the open *Air*, deſir'd the Judges to remove their Seat under ſome Roof, becauſe the *Light* offended him.

But now on the other ſide, the Men of *Works* and *Experiments* perhaps do not always handle the very ſame *Subjects* that are acted on the Stage of the *World*; yet they are ſuch as have a very great reſemblance to them. It is *Matter*, a viſible and ſenſible *Matter*, which is the Object of their *Labours:* And the ſame is alſo us'd by Men of practical Lives. This Likeneſs of their *Imployments* will ſoon make the one excel in the other. For it is far eaſier for him who has been converſant in one ſort of *Works*, to apply himſelf to any other; than for him who has only thought much, to turn a Man of *Practice:* As he that can paint the Face of a Man or a Lion, will much ſooner come to draw any other Creature, than he who has all the *Rules* of *Limning* in his Head, but never yet us'd his Hand to lay on a *Colour*.

And as for the *Terrors* and *Miſapprehenſions* which

commonly confound weaker Minds, and make Mens Hearts to fail and boggle at Trifles; there is ſo little hope of having them remov'd by *Speculation* alone, that it is evident they were firſt produc'd by the moſt *contemplative* Men amongſt the *Ancients*; and chiefly prevailed of late Years, when that way of *Learning* flouriſhed. The *Poets* began of old to impoſe the Deceit. They to make all Things look more venerable than they were, deviſ'd a thouſand falſe *Chimæras*; on every *Field*, *River*, *Grove*, and *Cave* they beſtow'd a *Fantaſm* of their own making: With theſe they amaz'd the World; theſe they cloath'd with what Shapes they pleas'd; by theſe they pretended, that all Wars, and Counſels, and Actions of Men were adminiſtred. And in the modern *Ages* theſe *Fantaſtical Forms* were reviv'd and poſſeſs'd *Chriſtendom*, in the very height of the *Schoolmens* time: An infinite Number of *Faries* haunted every Houſe; all Churches were fill'd with *Apparitions*; Men began to be frighted from their *Cradles*, which Fright continu'd to their *Graves*, and their Names alſo were made the Cauſes of ſcaring others. All which Abuſes if thoſe acute *Philoſophers* did not promote, yet they were never able to overcome; nay, even not ſo much as King *Oberon* and his inviſible *Army*.

But from the time in which the *real Philoſophy* has appear'd, there is ſcarce any whiſper remaining of ſuch *Horrors*: Every Man is unſhaken at thoſe Tales at which his *Anceſtors* trembled: The Courſe of Things goes quietly along in its own true Channel of *Natural Cauſes* and *Effects*. For this we are beholden to *Experiments*; which though they have not yet compleated the Diſcovery of the true World, yet they have already vanquiſh'd thoſe wild Inhabitants of the falſe

Worlds

Worlds, that us'd to aſtoniſh the Minds of Men. A Bleſſing for which we ought to be thankful, if we remember, that it is one of the greateſt Curſes that God pronounces on the Wicked, *that they ſhall fear where no fear is.*

From what I have ſaid may be gather'd, That *Experimental Philoſophy* will prevent Mens ſpending the ſtrength of their Thoughts about *Diſputes*, by turning them to *Works:* That it may well be attended by the united *Labours* of many, without wholly devouring the time of thoſe that *labour:* That it will cure our Minds of *romantic Swelling*, by ſhewing all Things familiarly to them, juſt as large as they are: That it will free them from *Perverſity*, by not permitting them to be too peremptory in their *Concluſions:* That it accuſtoms our Hands to Things which have a near reſemblance to the buſineſs of Life; and, that it draws away the Shadows which either inlarge or darken *human Affairs*. And indeed of the uſual Titles by which Men of Buſineſs are wont to be diſtinguiſh'd, the *Crafty*, the *Formal*, and the *Prudent*; the *Crafty* may anſwer to the *Empyric* in *Philoſophy*; that is, he is ſuch a one who has a great Collection of particular *Experiences*, but knows not how to uſe them but to baſe and low Ends. The *Formal* Man may be compar'd to the meer *Speculative Philoſopher:* For he vainly reduces every Thing to grave and ſolemn general *Rules*, without Diſcretion, or mature Deliberation. And laſtly, the *Prudent* Man is like him who proceeds on a conſtant and ſolid courſe of *Experiments*. The one in Civil Life neither wholly rejects the Wiſdom of *Ancient* or *Modern* times: The other in *Philoſophy* has the ſame reverence for *former Ages*, and regard for the *preſent*. The one does not reſt upon

empty

empty *Prudence*, but designs it for Action: The other does the same with his Discoveries: Upon a just, severe, and deliberate Examination of Things, they both raise their *Observations*, which they do not suffer to lie idle, but use them to direct the *Actions*, and supply the *Wants of human Life*.

Sect. XIII. *Experiments useful for the cure of Mens Minds.*

BESIDES what I have said of the help which *Experiments* will bring to our public *Duties*, and civil *Actions*, I promis'd to add something concerning the Assistance that they are able to give towards the Management of the private *Motions*, and *Passions* of our *Minds*: Of this I need say the less, because there is amongst the *Philosophers* a particular Science appointed for this Purpose, to prescribe Rules for calming our *Affections*, and conquering our *Vices*. However, I will not wholly pass it over in Silence: but I will try in few Words to make appear, that the *real Philosophy* will supply our Thoughts with excellent *Medicines* against their own *Extravagancies*, and will serve in some sort, for the same ends, which the *Moral* professes to accomplish.

If we shall cast an Eye on all the *Tempests* which arise within our Breasts, and consider the Causes, and Remedies of all the violent *Desires*, malicious *Envies*, intemperate *Joys*, and irregular *Griefs*, by which the Lives of most Men become *miserable*, or *guilty*; we shall find, that they are chiefly produc'd by *Idleness*, and may be most naturally cur'd by *Diversion*. Whatever *Art* shall be able to busy the *Minds* of Men, with a constant course of *innocent Works*, or to fill them with as vigorous and pleasant Images, as those ill *Impressions*, by which they are deluded; it will certainly have a surer effect in the composing and purifying

purifying of their Thoughts, than all the rigid Precepts of the Stoical, or the empty Distinctions of the *Peripatetic Moralists*.

Now then it is requir'd in that *Study*, which shall attempt, according to the force of *Nature*, to cure the Diseases of the Mind, that it keep it from *Idleness*, by full and earnest *Employments*; and that it possess it with innocent, various, lasting, and even sensible *Delights*.

How active and industrious the *Art* of *Experiments* ought to be, may be concluded from the whole tenour of my Discourse: wherein I have often prov'd, that it can never be finish'd by the perpetual *Labours* of any one Man, nay scarce by the successive force of the greatest *Assembly*.

That therefore being taken for granted, that it will afford eternal *Employments*: It is also as true, that it's Labours will contain the most *affecting*, and the most *diverting Delights*: And that thence it has Power enough to free the *Minds* of Men from their Vanities and Intemperance, by that very way which the greatest *Epicure* has no reason to reject, by opposing Pleasure against Pleasure.

And I dare challange all the corrupt *Arts* of our *Senses*, or the Devices of voluptuous Wits, to provide fuller, more changable, or nearer Objects, for the Contentment of Mens *Minds*. It were indeed to be wish'd, that severe Virtue itself, attended only by its own *Authority*, were powerful enough to establish its Dominion. But it cannot be so. The Corruptions, and Infirmities of *Human Nature* stand in need of all manner of Allurements, to draw us to Good, and quiet Manners. I will therefore propose for this End this Course of *Study*, which will not affright us with

with rigid Precepts, or ſour Looks, or peeviſh Commands, but conſiſts of ſenſible *Pleaſure*, and beſides will be moſt laſting in its Satisfaction, and innocent in its Remembrance.

What *Raptures* can the moſt *voluptuous* Men fancy, to which theſe are not equal? Can they reliſh nothing but the *Pleaſures* of their *Senſes?* They may here enjoy them without Guilt or Remorſe. Are they affrighted at the Difficulties of *Knowledge?* Here they may meet with a *Study*, that as well fits the moſt *negligent* Minds, as the moſt *induſtrious*. This conſiſts of ſo many *Works*, and thoſe ſo obvious, and facil, that the moſt laborious will never find Cauſe to be idle, and the moſt idle may ſtill have ſomething to do with the greateſt eaſe. In this they need not weary themſelves by ſearching for *Matter:* whatever they feel, or ſee, will afford them *Obſervations*. In this there is no tedious Preparation requir'd to fit them for ſuch Endeavours: as ſoon as they have the uſe of their *Hands*, and *Eyes*, and common *Senſe*, they are ſufficiently furniſh'd to undertake them. Though we cannot comprehend the *Arts* of Men without many previous *Studies*, yet ſuch is the Indulgence of *Nature*, that it has from the Beginning, out of its own Store, ſufficiently provided every Man with all Things, that are needful for the underſtanding of it ſelf.

Thus neither the *ſenſual Mind*, has any occaſion to contemn *Experiments* as unpleaſant, nor the idle as burdenſome, or intolerable, nor the virtuous as unworthy of his *Labours*. And the ſame Influence they may have on all other *moral* Imperfections of *human Nature*. What room can there be for low and little *Things* in a *Mind* ſo uſefully and ſucceſsfully employ'd?

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What *ambitious Diſquiets* can torment that Man, who has ſo much Glory before him, for which there are only requir'd the delightful *Works* of his *Hands?* What dark or melancholy Paſſions can overſhadow his *Heart*, whoſe Senſes are always full of ſo many various *Productions*, of which the leaſt Progreſs, and Succeſs, will affect him with an *innocent Joy?* What Anger, Envy, Hatred, or Revenge, can long torment his Breaſt, whom not only the greateſt, and nobleſt Objects, but every Sand, every Pebble, every Graſs, every Earth, every Fly can divert? To whom the return of every Seaſon, every Month, every Day, do ſuggeſt a Circle of moſt pleaſant *Operations?* If the *Antients* preſcrib'd it as a ſufficient *Remedy* againſt ſuch *violent Paſſions*, only to repeat the Alphabet over; whereby there was Leiſure given to the *Mind*, to recover itſelf from any ſudden Fury: Then how much more *effectual Medicines*, againſt the ſame *Diſtempers*, may be fetch'd from the whole Alphabet of *Nature*, which repreſents itſelf to our *Conſideration*, in ſo many infinite *Volumes!*

Sect. XIV. *Experiments not dangerous to the Chriſtian Religion.*

I will now proceed to the weightieſt, and moſt ſolemn Part of my whole *Undertaking*; to make a Defence of the *Royal Society*, and this new *Experimental Learning*, in Reſpect of the *Chriſtian Faith*. I am not ignorant, in what a ſlippery Place I now ſtand; and what a tender Matter I am enter'd upon. I know that it is almoſt impoſſible without Offence, to ſpeak of things of this *Nature*, in which all *Mankind*, each *Country*, and now almoſt every *Family*, do ſo widely diſagree among themſelves. I cannot expect that what I ſhall ſay will eſcape Miſinterpretation, though it be ſpoken with the greateſt Sim-

plicity, and Submiſſion, while I behold that moſt Men do rather value themſelves, and others, on the little Differences of *Religion*, than the main Subſtance itſelf; and while the Will of *God* is ſo variouſly diſtracted, that what appears to be *Piety* to ſome *Chriſtians*, is abhorr'd as the greateſt Superſtition and Hereſy by others.

However to ſmooth my Way as much as I can, and to prepare all our ſeveral *Spiritual Intereſts*, to read this Part with ſome tolerable *Moderation*; I do here, in the beginning, moſt ſincerely declare, that if this Deſign ſhould in the leaſt diminiſh the *Reverence* that is due to the *Doctrine of Jeſus Chriſt*, it were ſo far from deſerving *Protection*, that it ought to be abhorr'd by all the *Politic* and *Prudent*, as well as by the devout Part of Chriſtendom. And this, I profeſs, I think they were bound to do, not only from a juſt Dread of the *Being*, the *Worſhip*, the *Omnipotence*, the *Love of God*, all which are to be held in the higheſt Veneration, but alſo out of a Regard to the Peace and Proſperity of Men. In Matters that concern our *Opinions* of another *World*, the leaſt Alterations are of wonderful Hazard. How miſchievous then would that Enterprize be, whoſe Effects would aboliſh the *Command of Conſcience*, the Belief of a *Future Life*; or any of thoſe Heavenly *Doctrines*, by which not only the *Eternal Condition* of Men is ſecur'd, but their *Natural Reaſon*, and their *Temporal Safety* advanc'd? Whoever ſhall impiouſly attempt to ſubvert the Authority of the *Divine Power*, on falſe Pretences to better *Knowledge*, he will unſettle the ſtrongeſt Foundations of our *Hopes*: he will make a terrible Confuſion in all the Offices and Opinions of Men: he will deſtroy the moſt prevailing *Argument* to *Virtue*:

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he will remove all *Human Actions*, from their firmeſt Center: he will even deprive himſelf of the Prerogative of his *Immortal Soul*; and will have the ſame Succeſs that the *Ancient Fables* make thoſe to have had, who contended with their *God*, of whom they report, that many were immediately turn'd into *Beaſts*.

With theſe Apprehenſions I come to examine the *Objections*, which I am now to ſatisfy: and having calmly compar'd the *Arguments* of ſome devout Men againſt *Knowledge*, and chiefly that of *Experiments*; I muſt pronounce them both to be altogether inoffenſive. I did before affirm, that the *Royal Society* is abundantly cautious, not to intermeddle in *Spiritual Things*: But that being only a general Plea, and the Queſtion not lying ſo much on what they do at preſent, as upon the probable Effects of their Enterprize, I will bring it to the Teſt through the chief Parts of *Chriſtianity*; and ſhew that it will be found as much averſe from *Atheiſm*, in its Iſſue and Conſequences, as it was in its orginal Purpoſe.

The publick Declaration of the *Chriſtian Religion*, is to propoſe to Mankind an infallible Way to *Salvation*. Towards the Performance of this happy End, beſides the *Principles* of *Natural Religion*, which conſiſts in the Acknowledgment and Worſhip of a *Deity*, it has offer'd us the Merits of a glorious *Saviour*: By him, and his *Apoſtles Miniſtry*, it has given us ſufficient *Examples*, and *Doctrines*, to acquaint us with *Divine Things*, and carry us to *Heaven*. In every one of theſe, the *Experiments* of *Natural Things*, do neither darken our Eyes, nor deceive our Minds, nor deprave our Hearts.

Sect. XV. *Experiments will not destroy the Doctrine of the Godhead.*

First, there can be no just Reason assign'd, why an *Experimenter* should be prone to deny the Essence, and Properties of *God*, the universal Sovereignty of his *Dominion*, and his Providence over the *Creation*. He has before him the very same Argument to confirm his Judgment in all these; with which he himself is wont to be abundantly satisfy'd, when he meets with it in any of his *Philosophical Inquiries*. In every thing that he tries, he believes, that this is enough for him to rest on, if he finds, that not only his own, but the *universal Observations* of Men of all Times and Places, without any mutual Conspiracy, have consented in the same *Conclusion*. How can he then refrain from embracing this common *Truth*, which is witness'd by the unanimous Approbation of all *Countries*, the Agreement of *Nations*, and the secret Acknowledgment of every Man's Breast?

'Tis true, his *Employment* is about *material Things*. But this is so far from drawing him to oppose invisible *Beings*, that it rather puts his Thoughts into an excellent good Capacity to believe them. In every *Work* of *Nature* that he handles, he knows that there is not only a gross Substance, which presents itself to all Mens Eyes; but an infinite Subtilty of *Parts*, which come not into the sharpest Sense. So that what the *Scripture* relates of the Purity of *God*, of the Spirituality of his *Nature*, and that of *Angels*, and the *Souls* of Men, cannot seem incredible to him, when he perceives the numberless Particles that move in every Man's *Blood*, and the prodigious Streams that continually flow unseen from every *Body*. Having found that his own *Senses* have been so far assisted by the *Instruments* of *Art*, he may sooner admit,

mit, that his Mind ought to be rais'd higher, by a heavenly Light, in those things wherein his *Senses* do fall short. If (as the *Apostle* says) the invisible things of *God* are manifested by the visible; then how much stronger Arguments has he for his Belief, in the *eternal Power* and *Godhead*, from the vast Number of Creatures, that are invisible to others, but are expos'd to his View by the help of his *Experiments?*

Sect. XVI. *Experiments not injurious to the worship of God.*

Thus he is prepar'd to admit a *Deity*, and to embrace the Consequences of that Concession. He is also from his *Experiments* as well furnish'd with *Arguments* to adore it: He has always before his Eyes the *Beauty*, *Contrivance*, and *Order* of *God's Works:* From hence he will learn to serve him with all Reverence, who in all that he has made, consulted *Ornament*, as well as *Use*.

From hence he will best understand the infinite Distance between *himself* and his *Creator*, when he finds that all things were produc'd by him: Whereas he by all his Study, can scarce imitate the least Effects, nor hasten, or retard the common Course of *Nature*. This will teach him to *worship* that *Wisdom*, by which all things are so easily sustain'd, when he has look'd more familiarly into them, and beheld the Chances and Alterations, to which they are exposed. Hence he will be led to admire the wonderful Contrivance of the *Creation*; and so to apply, and direct his Praises aright; which, no doubt, when they are offer'd up to *Heaven*, from the Mouth of one, who has well studied what he commends, will be more suitable to the *Divine Nature*, than the blind Applauses of the Ignorant. This was the first Service that *Adam* perform'd to his *Creator*, when he obey'd him in mustring;

ſtring, and naming, and looking into the *Nature* of all the *Creatures*. This had been the only *Religion*, if Man had continued innocent in *Paradiſe*, and had not wanted a *Redemption*. Of this the *Scripture* itſelf makes ſo much Uſe, that if any devout Man ſhall reject all *Natural Philoſophy*, he may blot *Geneſis*, and *Job*, and the *Pſalms*, and ſome other Books out of the *Canon* of the *Bible*. *God* never yet left himſelf without Witneſs in the *World*: And it is obſervable, that he has commonly choſen the dark and ignorant *Ages*, wherein to work Miracles; but ſeldom or never the Times when *Natural Knowledge* prevail'd: For he knew there was not ſo much need to make uſe of extraordinary Signs, when Men were diligent in the Works of his Hands, and attentive on the Impreſſions of his Foot-ſteps in his *Creatures*.

It is almoſt a *proverbial* Speech, *that the moſt* Learned Ages *are ſtill* the moſt Atheiſtical, *and the* Ignorant *moſt* Devout. Whoever devis'd this Diſtinction at firſt, the true *Piety* is little beholden to him for it; for inſtead of obeying the *Jewiſh Law*, which forbids us to offer up to *God* a Sacrifice that has a Blemiſh, he has beſtow'd the moſt excellent of all the Race of Men on the Devil; and has only aſſign'd to *Religion* thoſe *Men* and thoſe *Times*, which have the greateſt Blemiſh of *Human Nature*, even a Defect in their *Knowledge* and *Underſtanding*.

If there can be found any Colour for this *Obſervation*, that the *Light* of *Reaſon* ſhould produce a *Spiritual Darkneſs*; it can only then hold good, when the *Knowledge* of Men, and not that of *Nature*, abounds. Whether the firſt be true, or no, let the *Politicians* conſider: But of the ſecond, this is a ſufficient Conviction, that in moſt Countries God has been worſhipp'd

ſhipp'd in a Form proportionable to that kind of *Natural Philoſophy* in which they excell'd. In *Perſia* where the Skill of the *Heavenly Motions* firſt began, they had their Temples on the Tops of Hills, and open to the Air. In *Ægypt* they had the beſt Opportunities of ſtudying the Nature of *living Creatures*; by reaſon of that variety which their River and their Land produc'd. And their *Religious Myſteries* were contain'd in *Hieroglyphicks*, which were moſt of them borrow'd from Beaſts. And why ſhould *Natural Philoſophy* be now condemn'd for contempt of all *Divinity*, when of old it did rather incline them to *Superſtition*, which is the other extreme? It is true indeed, by that *Knowledge* which they had of many Creatures, they were drawn to adore them; but that was only becauſe it was imperfect: If they had underſtood them throughly, they had never done it: So true is that Saying of my Lord *Bacon*, *That by a little Knowledge of Nature Men become Atheiſts; but a great deal returns them back again to a ſound and religious Mind.* In brief, if we rightly apprehend the Matter, it will be found that it is not only Sottiſhneſs, but Prophaneſs, for Men to cry out againſt the underſtanding of *Nature*; for that being nothing elſe but the Inſtrument of *God*, whereby he gives Being and Action to *Things*, the *Knowledge* of it deſerves ſo little to be eſteem'd impious, that it ought rather to be reckon'd as *Divine*.

Sect. XVII. *Experiments not prejudicial to the Doctrine of the Goſpel.*

But the chief Part of our *Religion*, on which the Certainty of all the reſt depends, is the *Evangelical Doctrine* of *Salvation* by *Jeſus Chriſt*. In this there is nothing from which he that converſes much with *Nature*, can be thought to be more averſe than others: nay,

nay, to which he may not be concluded to be more inclinable, on this very Account; seeing it has all been prov'd to him his own Way. Had not the appearance of *Christ* been strengthen'd by undeniable Signs of *Almighty Power*, no Age nor Place had been oblig'd to believe his Message. And these *Miracles* with which he asserted the *Truths* that he taught (if I might be allow'd this Boldness in a Matter so sacred) I would even venture to call *Divine Experiments* of his *Godhead*.

What then can there be in all this *Doctrine*, at which a real and impartial *Inquirer* into *natural Things*, should be offended? Does he demand a Testimony from *Heaven?* He has it: He reads Effects produc'd, that did exceed all mortal Skill and Force: And of this he himself is a better Judge than others: For to understand aright what is *Supernatural*, it is a good Step first to *know* what is according to *Nature*.

Does he require that this should be testified, not by Men of *Craft* or *Speculation*; but rather by Men of *Honesty*, *Trades*, and *Business?* The *Apostles* were such. Will he not consent to any Man's *Opinions*, unless he sees the *Operations* of his Hands agree with them? *Christ* himself requires no more of any of his *Followers:* For he commanded his *Disciples* not to believe him, but the *Works* that he did. Does he think that it is the most honourable Labour to study the Benefit of Mankind? to help their Infirmities? to supply their Wants? to ease their Burdens? He here may behold the whole *Doctrine* of *Future Happiness* introduc'd by the same Means; by feeding the Hungry, by curing the Lame, and by opening the Eyes of the Blind: All which may be call'd *Philosophical Works*, perform'd by an *Almighty Hand*.

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What then can hinder him from loving and admiring this *Saviour*, whose *Design* is so comfortable to his own, but his *Ability* so much greater? What Jealousy can he have of an Imposture in this *Messias?* Who though his *Doctrine* was so pure and venerable, though his *Life* was so blameless, though he had the Power of *Heaven* and *Earth* in his Hands, though he knew the Thoughts of Men, and might have touch'd and mov'd them as he pleas'd; did yet not rely on his *Doctrine*, on his *Life*, on the irresistible Assistance of *Angels*, or on his own *Divinity* alone; but stoop'd to convince Men by their *Senses*, and by the very same Course by which they receive all their *Natural Knowledge*.

§. XVIII. *Experiments will not overthrow the Doctrine of the Primitive Church.*

THE last *Doctrinal* Part of our *Religion* I shall mention, consists of those *Doctrines* which have been long since deduced by Consequences from the *Scripture*, and are now settled in the Body of that *Divinity*, which was deliver'd down to us by the *Primitive Church*, and which the generality of *Christendom* embraces. It may here be suggested, that the sensible *Knowledge* of *Things* may in time abolish most of these, by insinuating into Mens Minds that they cannot stand before the Impartiality of *Philosophical Inquisitions*. But this Surmise has no manner of Foundation. These Superstructures are of two Sorts: Either those of which a Man may have a clear Apprehension in his Thoughts, upon a rational Account, and which are intelligible to any ordinary Reader; or else such as exceed the common Measures of our *Reason* and *Senses*. There will be no Fear that an *Experimenter* should reject the first, seeing they may be conceiv'd by the meanest Capacity, and have that Stamp upon them,

them, which he for the moſt part eſteems the Character of *Truth*, that they are vulgar. But now towards the conſenting to the laſt, there is nothing better than to believe them in groſs; and for this he is as well prepar'd as any other *Philoſopher*. If we ſuppoſe him ſufficiently convinc'd of the Authority of the Deliverer, (as I have already ſhewn he may be) he cannot be ſuſpected for diſavowing his Word, though never ſo myſtical, or for reſiſting the Voice of him whoſe Arm he has found to be Omnipotent. This Submiſſion of his *Judgment* he may make, notwithſtanding the Severity of his *Inquiries*; and the moſt ſubtil ſpeculative Man in the World can do no more. After all his acute *Arguings* in *Divinity*, he can never render any one Point, which is the proper Object of *Faith*, to be plain, and equal, and expreſſible to our *Reaſon*. What good can he then do? ſeeing he is not able to make it any way fitter for our *Faith*, by all his *Tranſcendental Notions*, than it was before on the bare Account of the *wondrous Works* of the *Author*.

This is the Place in which the *Peripatetic Philoſophy* has long triumph'd; but I cannot imagine on what Right. The ſpiritual and ſupernatural Part of *Chriſtianity* no *Philoſophy* can reach; and in the plain things there is no need of any at all; ſo that it is excluded on both Accounts. In ſome *Doctrines* it is uſeleſs, by reaſon of their Sublimity; in others, becauſe of their Commonneſs. How ſmall Aſſiſtance it brings, may be ſeen in thoſe very Points in which its Empire ſeems moſt to be plac'd, in *God's Decrees*, his *Immateriality*, his *Eternity*, and the holy Myſtery of the *Trinity*: in all which we are only brought into a more learned Darkneſs by it; and in which unfathomable Depths

Depths a plain *Believing* is at last acknowledg'd by all to be our only Refuge. The Truth is, notwithstanding the great Stir they have made about *Religion*, if we had only follow'd their Light, we had still worshipp'd the *Creator* and *Redeemer* of the *World* under the same Title by which their Predecessors did formerly at *Athens*, as the *unknown God*.

This I have urg'd so far, because I am confident that the reducing of *Christianity* to one particular Sect of *Philosophy*, and confining it to that, is one of the most destructive Engines that ever was manag'd against it. Of this the Church of *Rome*, for her Share, has already found the ill Effects: And the Danger is apparent: For by this means the Benefit of *Religion* will become very narrow, seeing where *Reason* takes Place, it will only convince them who are of the same Opinions in *Philosophy* with those that convert them: And also, (that which is worse) if ever by any Fate of *Times*, or Change of *Governments*, or Succession of new *Arts*, that Sect shall chance to be quite broken, the *Doctrine* of *Christ*, relying upon it, were inevitably ruin'd, unless *God* were pleas'd to support it a supernatural Way, or to restore it again by new *Miracles*. *Religion* ought not to be the Subject of *Disputations:* It should not stand in need of any Devises of *Reason:* It should in this be like the temporal Laws of all Countries, towards the obeying of which there is no need of *Syllogisms* or *Distinctions*; nothing else is necessary but a bare Promulgation, a common Apprehension, and Sense enough to understand the Grammatical Meaning of ordinary Words. Nor ought *Philosophers* to regret this Divorce; seeing they have almost destroy'd themselves, by keeping *Christianity* so long under their Guard; by fetching *Religion* out of the *Church*

and carrying it Captive into the *Schools*, they have made it suffer Banishment from its proper Place: And they have withal thereby very much corrupted the Substance of their own *Knowledge*: They have done as the *Philistines* by seizing on the *Ark*; who by the same Action depriv'd the People of *God* of their *Religion*, and also brought a Plague amongst themselves.

Sect. XIX. *Experiments will not hinder the Practice of Religion.*

THUS far I trust it will be confess'd, that *Experiments* are unblameable. But yet there is much more behind, of which many pious Men are wont to express their Jealousy. For though they shall be brought to allow, that all these *Doctrines*, which I have named, may seem to remain safe amidst the Studies of *Natural Things*: Yet they still whisper, that they may chance by degrees, to make the Sincerity of Devotion appear ridiculous, and to bring the Strictness of holy Life out of Fashion: And that so they will silently, and by Piece-meals, demolish *Religion*; which they dare not openly encounter. I will therefore next endeavour the Removal of these Scruples; though I sufficiently understand, that it is a very *difficult Work*, to confute such popular and plausible Errors, which have the Pretence of the Cause of *God* to confirm them.

The chief Substance of real and sober *Piety*, is contain'd in the devout Observation of all those Ways whereby *God* has been pleas'd to manifest his Will; and in a right Separation of our Minds from the Lusts and Desires of the *World*. The most remarkable Means, whereby he has made known his Pleasure, are those which have been fix'd and reveal'd in his *Word*; or else the extraordinary Signs of his Authority, and Command.

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Concerning our Acknowledgment of his *reveal'd Will* in the *Scripture*, I have already spoken. And our Obedience to the latter, consists chiefly of two Kinds; an humble Submission to *Divine Prophecies*; and a careful Observance of all *remarkable Providences*. In both which *Experimental Philosophy* may well be justify'd. It may perhaps correct some Excesses which are incident to them: But it declares no Enmity against the things themselves.

The Sum of all the whole *Doctrine* of *Prophecies* is this, that the *great Creator* of the World has the Prerogative of foreseeing, appointing, and predicting all future Events: That he has often, in former Ages, made use of this Power, by the Visions and Raptures of holy Men inspir'd from above; that his *infinite Wisdom* has still the like Ability to do the same; that whenever such Predictions are accompanied with undeniable Testimonies of their being sent from *Heaven*, they ought to be peferr'd before all *humane Laws*.

The true Foundation of *divine Prodigies*, is much of the same Nature with the other: It relies on these Suppositions, that all the Creatures are subject to *God's Word*, by which they were made; that he can alter their *Courses*, exalt or destroy their *Natures*, and move them to different Ends from their own, according to his Pleasure; that this he has often done heretofore; that still his Arm is not weakned, nor the same *Omnipotence* diminish'd; that still he may change the wonted Law of the *Creation*, and dispose of the *Beings* and *Motions* of all Things, without controul; and that when this is done, it is with a peculiar Design of punishing, or rewarding, or forewarning Mankind.

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To the Belief and Assertion of these *Doctrines*, we are oblig'd by the very end of *Religion* itself. But yet their counterfeit Colours have seduc'd many virtuous Minds into manifold Mischiefs.

The Mistakes about *Prophecies* may arise either from our abusing of the old, or a vain setting up of new. We err in the first, when we translate the ancient *Prophecies* from those Times and Countries, which they did properly regard, to others, which they do not concern. And we offend in the second, when we admit of new *Prophetical Spirits* in this Age, without the uncontroulable Tokens of *Heavenly Authority*.

We are guilty of false Interpretations of *Providences* and *Wonders*, when we either make those to be *Miracles* that are none, or when we put a false Sense on those that are real; when we make general Events to have a private Aspect, or particular Accidents to have some universal Signification. Though both these may seem at first to have the strictest Appearance of *Religion*, yet they are the greatest Usurpations on the Secrets of the *Almighty*, and unpardonable Presumptions on his high *Prerogatives* of *Punishment* and *Reward*.

Sect. XX. *Experiments will not destroy the Doctrine of Prophecies, and Prodigies.*

And now if a moderating of these Extravagancies must be esteem'd Prophaneness, I profess, I cannot absolve the *Experimental Philosopher*. It must be granted, that he will be very scrupulous, in believing all manner of Commentaries on *Prophetical Visions*, in giving Liberty to new *Predictions*, and in assigning the Causes, and marking out the Paths of *God's Judgments* amongst his *Creatures*.

He cannot suddenly conclude all extraordinary Events to be the immediate Finger of *God*, because he familiarly

familiarly beholds the inward Workings of Things; and thence perceives that many Effects, which use to affright the *Ignorant*, are brought forth by the common *Instruments* of *Nature*. He cannot be suddenly inclin'd to pass Censure on Mens eternal Condition, from any *Temporal Judgments* that may befal them; because his long Converse with all Matters, Times, and Places, has taught him the Truth of what the *Scripture* says, that *all things happen alike to all*. He cannot blindly consent to all Imaginations of devout Men, about future *Contingencies*; seeing he is so rigid in examining all particular Matters of Fact: he cannot be forward to assent to *Spiritual Raptures* and *Revelations*, because he is truly acquainted with the Tempers of Mens Bodies, the Conposition of their Blood, and the Power of Fancy; and so better understands the Difference between *Diseases* and *Inspirations*.

But in all this he commits nothing that is *irreligious*. 'Tis true, to deny that *God* has heretofore warn'd the World of what was to come, is to contradict the very Godhead itself; but to reject the Sense, which any private Man shall fasten to it, is not to disdain the Word of *God*, but the Opinions of Men like ourselves. To declare against the Possibility, that new *Prophets* may be sent from *Heaven*, is to insinuate that the same infinite Wisdom, which once shew'd itself that Way, is now at an end. But to slight all Pretenders that come without the help of *Miracles*, is not a Contempt of the Spirit, but a just Circumspection, that the *Reason* of Men be not over-reach'd. To deny that God directs the Course of human Things, is Stupidity; but to hearken to every *Prodigy*, that Men frame against their Enemies, or for themselves,

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is not to reverence the *Power of God*, but to make that ſerve the Paſſions, and Intereſts, and Revenges of Men.

It is a dangerous Miſtake, into which many good Men fall; that we neglect the *Dominion of God over the World*, if we do not diſcover, in every Turn of human Actions, many ſupernatural *Providences* and miraculous *Events*. Whereas it is enough for the Honour of his *Government*, that he guides the whole Creation, in its wonted Courſe of *Cauſes* and Effects: As it makes as much for the Reputation of a Prince's Wiſdom, that he can rule his Subjects peaceably, by his known and ſtanding Laws, as that he is often forc'd to make uſe of extraordinary Juſtice to puniſh, or reward.

Let us then imagine our *Philoſopher* to have all ſlowneſs of Belief, and rigour of Trial, which by ſome is miſcalled a blindneſs of Mind, and hardneſs of Heart. Let us ſuppoſe that he is moſt unwilling to grant that any thing exceeds the Force of *Nature*, but where a full Evidence convinces him. Let it be allow'd, that he is always alarm'd, and ready on his Guard, at the Noiſe of any *miraculous Event*; leſt his Judgment ſhould be ſurpriz'd by the Diſguiſes of *Faith*. But does he by this diminiſh the *Authority* of *ancient Miracles*? Or does he not rather confirm them the more, by confining their Number, and taking care that every Falſhood ſhould not mingle with them? Can he by this undermine *Chriſtianity*, which does not now ſtand in need of ſuch extraordinary Teſtimonies from *Heaven*? or do not they rather indanger it, who ſtill venture all its Truths on ſo hazardous a Chance? Who requires a Continuance of

*Signs*,

*Signs* and *Wonders*, as if the Works of our *Saviour* and his *Apoſtles* had not been ſufficient: Who ought to be eſteem'd the moſt carnally minded, the *Enthuſiaſt*, that pollutes his *Religion* with his own Paſſions, or the *Experimenter*, that will not uſe it to flatter and obey his own Deſires, but to ſubdue them? Who is to be thought the greateſt Enemy of the *Goſpel*, he that loads Mens *Faiths* by ſo many improbable Things, as will go near to make the Reality itſelf ſuſpected, or he that only admits a few *Arguments*, to confirm the *Evangelical Doctrines*, but then chuſes thoſe that are *unqueſtionable?* It cannot be an ungodly purpoſe to ſtrive to aboliſh all *Holy Cheats*, which are of fatal Conſequence, both to the Deceivers, and thoſe that are deceiv'd: To the Deceivers, becauſe they muſt needs be *Hypocrites*, having the Artifice in their keeping: To the Deceiv'd, becauſe if their Eyes ſhall be ever open'd, and they chance to find, that they have been deluded in any one thing, they will be apt not only to reject that, but even to deſpiſe the very *Truths* themſelves, which they had before been taught by thoſe Deluders.

It were indeed to be confeſs'd, that this Severity of *Cenſure* on *Religious Things*, were to be condemn'd in *Experimenters*, if while they deny any Wonders that are falſely attributed to the *True God*, they ſhould approve thoſe of Idols or falſe *Deities*. But that is not objected againſt them. They make no Compariſon between his Power, and the Works of any others, but only between the ſeveral ways of his own manifeſting himſelf. Thus if they leſſen one Heap, yet ſtill they increaſe the other: In the main they diminiſh nothing of his Right. If they take from the *Prodigies*, they add to the ordinary *Works* of the

ſame *Author*. And thoſe ordinary *Works* themſelves, they do almoſt raiſe to the height of *Wonders*, by the exact Diſcovery which they make of their Excellencies: While the *Enthuſiaſts* goes near to bring down the Price of the true and primitive *Miracles*, by ſuch a vaſt, and ſuch a negligent augmenting of their Number.

Sect. XXI. *On this account Experiments are fit for the preſent Temper of our Nation.*

By this I hope it appears, that this inquiring, this ſcrupulous, this incredulous Temper, is not the Diſgrace, but the Honour of *Experiments*. And therefore I will declare them to be the moſt ſeaſonable Study, for the preſent *Temper* of our *Nation*. This wild amuſing Mens Minds with *Prodigies*, and Conceits of *Providences*, has been one of the moſt conſiderable Cauſes of thoſe ſpiritual Diſtractions, of which our Country has long been the *Theatre*. This is a Vanity to which the *Engliſh* ſeem to have been always ſubject above others. There is ſcarce any *Modern Hiſtorian*, that relates our Foreign Wars, but he has this *Objection* againſt the *Diſpoſition* of our Countrymen, that they us'd to order their Affairs of the greateſt Importance, according to ſome obſcure *Omens*, or *Prædictions*, that paſs'd about amongſt them, on little or no Foundations. And at this time, eſpecially this laſt Year, this gloomy, and ill-boding humour has prevail'd. So that it is now the fitteſt Seaſon for *Experiments* to ariſe, to teach us a Wiſdom, which ſprings from the depths of *Knowledge*, to ſhake off the Shadows, and to ſcatter the Miſts, which fill the Minds of Men with a vain Conſternation. This is a *Work* well-becoming the moſt *Chriſtian Profeſſion*. For the moſt apparent Effect, which attended the Paſſion of *Chriſt*, was the putting of an eternal ſilence

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on all the falſe Oracles, and diſſembled Inſpirations of *ancient Times.*

There have been, 'tis true, ſome peculiar Occaſions wherein *God* was pleaſed to convince the World from *Heaven* in a viſible manner. But if we conſider the *Arguments* that us'd to move him to it, we may conclude that ſuch wonderful Signs are not often now to be expected.

He has either done it in Times of groſs Ignorance, or in the beginning of a new way of *Religion*, or for the peculiar Puniſhment of ſome prevailing Wickedneſs: Upon the account of the two firſt, we have no reaſon to expect Wonders in this *Age:* Becauſe all ſorts of *Knowledge* do ſo much abound; and becauſe we have a *Religion* already eſtabliſh'd, againſt which the Gates of Hell ſhall never prevail.

The third time has been, when *God* has taken to himſelf, the *Exemplary Puniſhment* of ſome heinous Sin. From this indeed our *Age* is no more exempted, than it is free from thoſe Vices that are wont to provoke the *Divine Vengeance.* This then we confeſs, that even at this preſent *God* may declare himſelf againſt the Iniquities of Men, by the ſupernatural Tokens of his Diſpleaſure: But yet the Interpretation of ſuch Puniſhments ought to be handled with the greateſt Tenderneſs. For as it is ſaid of the laſt and general Judgment, *that no Man knows the time when it ſhall happen;* ſo we may alſo affirm of theſe particular *Judgments*, That there is no Man who underſtands the Circumſtances, or Occaſions of their Infliction, but they are one of the deepeſt parts of *God*'s unſearchable Councils.

Whenever therefore a heavy Calamity falls from *Heaven* on our *Nation*, an *univerſal Repentance* is re-

quir'd; but all particular Applications of private Men, except to their own Hearts, is to be forborn. Every Man muſt bewail his own *Tranſgreſſions*, which have increas'd the *Publick Miniſtry*. But he muſt not be too haſty in aſſigning the Cauſes of *Plagues*, or *Fires*, or *Inundations*, to the Sins of other Men. Whoever thinks that way to repent, by condemning the Miſcarriages of thoſe Parties that differ from his own, and by reproving them as the *Authors* of ſuch *Miſchiefs*, he is groſly miſtaken: For that is not to repent, but to make a Satire: That is not an Act of Humiliation, but the greateſt *Spiritual Pride*.

It is indeed a Diſgrace to the Reaſon and Honour of Mankind, that every fantaſtical *Humouriſt* ſhould preſume to interpret all the *ſecret Ordinances* of *Heaven*; and to expound the Times, and Seaſons, and Fates of Empires, though he be never ſo ignorant of the very common *Works* of *Nature* that lie under his Feet. There can be nothing more injurious than this, to Mens publick or private Peace. This withdraws our Obedience from the true Image of *God*, the rightful Sovereign, and makes us depend on the vain Images of his Power, which are fram'd by our own *Imaginations*: This weakens the Conſtancy of human Actions: This affects Men with Fears, Doubts, Irreſolutions, and Terrors. It is uſually obſerv'd, that ſuch *Preſaging*, and *Prophetical Times*, do commonly fore-run great *Deſtructions* and *Revolutions* of human Affairs. And that it ſhould be ſo is natural enough, though the *Preſages* and *Prodigies* themſelves did ſignify no ſuch Events. For this *melancholy*, this *frightful*, this *Aſtrological* humour diſarms Mens Hearts, it breaks their Courage, it confounds their Councils, it makes them help to bring

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ſuch *Calamities* on themſelves: Firſt, they fancy that ſuch ill Accidents muſt come to paſs; and ſo they render themſelves fit Subjects to be wrought upon; and very often become the *Inſtruments*, to bring thoſe Effects about, which they fondly imagin'd were inevitably threaten'd them from *Heaven*.

Sect. XXII. *Experiments not prejudicial to Mortification.*

THE laſt *Accuſation* concerns that which is neceſſary to a *holy Life*, the *mortifying* of our *Earthly Deſires*. And here the Men of a retir'd and ſevere Devotion are the loudeſt: For they tell us, that we cannot conquer and deſpiſe the *World* while we ſtudy it ſo much: that we cannot have ſufficient leiſure to reflect on another Life, while we are ſo taken up about the Curioſities of this; that we cannot be ſtrict enough in correcting the Irregularities of our own Thoughts, while we give them ſo much liberty to wander, and ſo pleaſant a Road wherein to travel; and that it is in vain to ſtrive after the *Purity* and *Holineſs* of our Minds, while we ſuffer them to ſpend ſo much Time on the Labours of our *Senſes*. This *Objection* appears at firſt ſight ſomewhat terrible: But I come the more boldly to anſwer it, becauſe there are involv'd in the ſame Indictment, all the moſt innocent *Arts*, and civil *Actions* of Men, which muſt either ſtand or fall with *Experiments* in this Trial.

Firſt then I will alledge, that if this ſort of *Study*, ſhould be acknowledg'd not to be proper, for the promoting of the ſeverer Offices of *Chriſtianity*, yet it would ſufficiently recompence for that, by the Aſſiſtance it may bring to ſome other kinds of *Chriſtian Virtues*: If it ſhall not fill our Minds with the moſt mortifying Images, which may riſe from the Terrors

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of *God's Justice*, yet it will make amends for that, by inclining us to adore his *Goodness*. If it fits us not so well for the Secrecy of a *Closet*, it makes us serviceable to the *World*. If it shall not seem to contribute towards *Godly Sorrow*, or *Contrition*, it will give us more Opportunities of *Charity*, *Affability*, *Friendship*, and *Generosity*, which are all of them *Divine Graces*, as well as *Faith*, and *Repentance*.

It is a great Error to think that *Religion* does only consist in one sort of *Duties*. It is as various as the Dispositions, the Qualities, the Conditions of Men: With some, the severe, the strict, the retir'd are best: with others, the bountiful, the affable, the cheerful, the friendly: Of both which kinds I will not say whether is to be preferr'd: But this is true, that while the first are chiefly limited to the regulating of our own *Hearts*, the influence of the last extends much farther; to spread the Fame of the *Gospel* in the *World*; to make it appear lovely in the Eyes of all Beholders; and to allure them to submit to the honourableness, the gentleness, the easiness of its Yoke. And this methinks is evident in our *Saviour's* Life: For whenever he intended to convert any to his *Faith*, he did it by some visible *good Work*, in the sight of the Multitude. But he never gain'd any *Disciple* by the Conflicts which he was pleas'd to undergo in his own Mind; for he perform'd his *Fast*, and his *Agony* alone, in the *Wilderness*, and the *Garden*.

In the next place I will affirm, That it is improbable that even the hardest and most rigorous parts of *Mortification* itself should be injur'd by these *Studies* more than others; seeing many Duties of which it is compos'd, do bear some resemblance to the Qualifications

cations that are requisite in *Experimental Philosophers*. The spiritual *Repentance* is a careful survey of our former Errors, and a Resolution of amendment. The spiritual *Humility* is an Observation of our Defects, and a lowly Sense of our own Weakness. And the *Experimenter* for his part must have some Qualities that answer to these: He must judge aright of himself; he must misdoubt the best of his own Thoughts; he must be sensible of his own Ignorance, if ever he will attempt to purge and renew his Reason: So that if that be true, which is commonly observ'd, that Men are wont to prove such kinds of *Christians* as they were Men before; and that Conversion does not destroy, but only exalt our *Tempers*; it may well be concluded, that the doubtful, the scrupulous, the diligent *Observer* of Nature, is nearer to make a modest, a severe, a meek, an humble *Christian*, than the Man of *Speculative Science*, who has better thoughts of himself and his own *Knowledge*.

But I need not take so great a Compass in this Vindication, when it may be fairly maintain'd, that the true and unfeign'd *Mortification* is not at all inconsistent with Mens consulting of their Happiness in this World, or being employ'd about earthly Affairs. The honest pursuit of the Conveniencies, Decencies, and Ornaments of a mortal Condition, by just and regular ways, is by no means contradictory to the most real and severe Duties of a *Christian*. It is true indeed, the irregular Prosecution of such Things is an offence to *Religion*: but so it is also to *right Reason*, and *Nature* itself.

It is a wrong Conception of the State of *Grace*, if Men believe, that when they enter upon it, they must presently cast away all the Thoughts and Desires

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of *Humanity*. If this were so, to sanctify our *Natures*, were not to renew, but to destroy them. When we are commanded to *put off the old Man*, we are not enjoin'd to renounce our Faculties of *Reason*. When we are bidden *not to think our own Thoughts*, it is not intended that we should forbear all *Natural Actions* and *Inclinations*. Such *Scriptures* as these are to be understood in a moderate Sense: By such Expressions the Irregularity of the *Lust*, and not the *Natural Desire* is condemn'd; the *Piety* and *Innocence* of our *Lives*, and not the utter Change of our *Estate*, is recommended. Seeing the *Law* of *Reason* intends the Happiness and Security of Mankind in this Life; and the *Christian Religion* pursues the same Ends, both in this and a future Life; they are so far from being opposite one to another, that *Religion* may properly be stiled the best and the noblest Part, the Perfection and the Crown of the Law of *Nature*.

I will therefore first demand, whether it be not lawful for the strictest *Christian* to provide for the Necessities of this Life? This Request is modest enough: For if they deny it, they will reduce Mankind into a Condition which is literally worse than that of the Beasts that perish; seeing to them it is natural to seek out for all the ways of their own Preservation. I will go on to ask them, whether it be a Breach of the *Law of Christianity*, to labour for the Advantages of Living, which are enjoy'd by others? If this be refus'd me, we shall not deprive it of that Honour which now justly belongs to it, that there is little Civility at present amongst Men without the Pale of the *Christian Church*.

But, in few Words, let them tell me, whether it be indispensably necessary for us to be always thinking of

of heavenly Things? If so, how far short were the very Apostles of this Character of *Sanctity*, which these Men would prescribe us? What Traffick, what Commerce, what Government, what secular Employment could be allowed? Where should we at last make an end of refining? What would become of all the Men of Trade themselves, of whom this Age has shewn so many Pretenders to the purest *Religion*.

Let it only therefore be granted, that we are *Men*, and not *Angels*: Let it be confess'd, that there may be an *Excess*, as well as *Defect*, in Men's Opinions of Holiness: And then I will make no scruple to say, that the *Philosopher* defiles not his Mind when he labours in the *Works* of *Nature*; that the Diversion they give him, will stand with the greatest Constancy, and the Delight of pursuing them, with the Truth and Reality of *Religion*. But to say no more, How can it be imagin'd to be a sinful and carnal Thing, to consider the Objects of our *Senses*; when *God*, the most *spiritual Being*, did make them all? Since they first were conceiv'd in his unspotted Mind, why may they not innocently enter into ours? For if there be any Pollution which necessarily flows from thinking of them, it might as well be concluded to stick on the *Author*, as on the *Souls* of them that only observe them.

§. XXIII. *Experiments not dangerous to the Church of England.*

And now having insisted so long on the Parts of the *Christian Religion* in General, it will be less needful that I should be large in vindicating this *Design* from the Imputation of being prejudicial to the *Church of England*: For this has the same Interest with that, and differs in nothing from its primitive Pattern, but only in the addition of some Circumstances, which make it fit for this *Age*, and this *Place*: And therefore they

will both be ſtrengthen'd by the ſame Benefits, and weaken'd by the ſame Miſchiefs.

What I have then to add concerning our *Church*, ſhall be compriz'd in theſe Particulars: That it can never be prejudic'd by the Light of *Reaſon*, nor by the Improvements of *Knowledge*, nor by the Advancement of the *Works* of Mens Hands.

For the proof of the Firſt, it will be ſufficient to conſider its *True Deſign*, what *Opinions* it principally encounters, and by what *Arguments* it ought to defend itſelf.

The true and certain Intereſt of our *Church* is to derive its *Doctrine* from the plain and unqueſtion'd parts of the *Word of God*, and to keep itſelf in a due Submiſſion to the *Civil Magiſtrate*. The Extremes which it oppoſes, are *implicit Faith*, and *Enthuſiaſm*: And it is a great Miſtake, if Men think it cannot be maintain'd againſt theſe, but by the mutual *Arguments* of its Enemies; that it cannot withſtand the *Separatiſts*, but by the Authority of the *Church of Rome*; nor diſſent from the *Church of Rome*, but on the *Tenents* of the *Separatiſts*. The Grounds on which it proceeds are different from both; and they are no other but the Rights of the *Civil Power*, the Imitation of the firſt uncorrupt *Churches*, and the *Scripture* expounded by *Reaſon*: From whence may be concluded, that we cannot make War againſt *Reaſon*, without undermining our own Strength, ſeeing it is the conſtant Weapon we ought to employ.

From this I will farther urge, That the *Church of England* will not only be ſafe amidſt the Conſequences of a *Rational Age*, but amidſt all the Improvements of *Knowledge*, and the Subverſion of old Opinions about *Nature*, and Introduction of new ways of reaſoning

ſoning thereon. This will be evident, when we behold the Agreement that is between the preſent *Deſign* of the *Royal Society*, and that of our *Church* in its Beginning. They both may lay equal claim to the word *Reformation*; the one having compaſs'd it in *Religion*, the other purpoſing it in *Philoſophy*. They both have taken a like courſe to bring this about; each of them paſſing by the *corrupt Copies*, and referring themſelves to the *perfect Originals* for their Inſtruction; the one to the *Scripture*, the other to the large Volume of the *Creatures*. They are both unjuſtly accus'd by their Enemies of the ſame Crimes, of having forſaken the *Ancient Traditions*, and ventur'd on *Novelties*. They both ſuppoſe alike, that their *Anceſtors* might err; and yet retain a ſufficient Reverence for them. They both follow the great Precept of the *Apoſtle*, of *trying all Things*. Such is the Harmony between their *Intereſts* and *Tempers*. It cannot therefore be ſuſpected, that the *Church of England*, that aroſe on the ſame Method, though in different Works; that heroically paſs'd through the ſame Difficulties, that relies on the ſame *Sovereign's Authority*, ſhould look with jealous Eyes on this *Attempt*; which makes no change in the Principles of Mens Conſciences, but chiefly aims at the Increaſe of *Inventions* about the *Works* of their Hands.

This was the laſt Particular in this Subject which I undertook to make good; That our *Church* can never be impair'd by the Growth of the uſeful *Arts* of *Life*. But now I come nearer to it, I find that I may ſafely omit it: For the thing itſelf is ſo manifeſt, that there can be no ground of raiſing a Queſtion about it. If our *Church* ſhould be an Enemy to Commerce, Intelligence, Diſcovery, Navigation, or any ſort of *Mecha-*

*nics*; how could it be fit for the present *Genius* of this *Nation*? What greater Advantage could its Adversaries have against it? How should we be able to reconcile these two Titles, which so justly belong to our *King*, of *Defender of the Faith*, and *Patron of Experimental Knowledge*.

But in this I am not only encourag'd to promise, that our *Church* will be out of all danger; but to recommend this *Enterprize* to it, as that which will become its other *Excellencies*, and is most worthy of its *Protection*. And I shall most humbly represent to its Consideration, that this is not only an honourable *Work*, but even a necessary *Duty*, to which it is oblig'd by *Natural Affection*. The present *inquiring Temper* of this *Age* was at first produc'd by the Liberty of Judging, and Searching, and Reasoning, which was us'd in the first *Reformation*. Though I cannot carry the Institution of the *Royal Society* many Years back, yet the Seeds of it were sown in King *Edward* the Sixth's and Queen *Elizabeth*'s Reign: And ever since that time *Experimental Learning* has still retain'd some vital Heat, though it wanted the Opportunities of ripening itself, which now it enjoys. The *Church of England* therefore may justly be styl'd the *Mother* of this sort of *Knowledge*; and so the Care of its *Nourishment* and *Prosperity* peculiarly lies upon it.

And indeed this is an Honour which seems reserv'd for it alone. For all the several sorts of *Enthusiasts*, I fear, there cannot much help be expected towards such *Works*, till they shall have left off to abhor them under the Title of *vain Philosophy*.

The *Reformed Churches* of other Countries, though they have given us many Men, who have been eminent in this way, yet are not in a Condition to promote

mote it by themſelves: For either they have not the Encouragement of the *Magiſtrate*; or thoſe that have, are cut ſo ſhort in their Revenue, that they have ſcarce enough to ſupport the Decence of their own publick Worſhip.

The *Church of Rome* has indeed of late look'd more favourably upon it. They will now condemn no Man for aſſerting the *Antipodes*: The Severity with which they handled *Galileo*, ſeems now very much abated: They now permit their *Jeſuits* to beſtow ſome Labours about *Natural Obſervations*, for which they have great Advantages by their Travels; and their *Clergy* may juſtly claim ſome ſhare in this Honour, as long as the immortal Names of *Merſennus* and *Gaſſendus* ſhall live.

But ſtill it is a queſtion, whether that *Church* does not rather connive at, than really intend its Progreſs. They have indeed ſeiz'd on ſome parts of *New Philoſophy*; but perhaps it is only with the ſame Policy that we often ſee great *Monarchs* uſe, in retaining ſome Out-Province of their *Empire*; who, though they find that the Benefit does not countervail the Charge of the keeping it, yet will not wholly quit their Intereſt in it, leſt their *Neighbours* ſhould get Poſſeſſion, and fortify it againſt them. Thus it is likely they have cheriſh'd ſome *Experiments*, not out of Zeal to the continuance of ſuch *Studies*, but that the *Proteſtants* might not carry away all the Glory, and thence withal get new Strength to oppoſe them.

This Undertaking therefore is wholly caſt on the *Church of England*, which can have no Jealouſy of its Effects, to which *Ignorance* is not a Support, but an Enemy; which aims not at the Captivity, but the Freedom of Mens Minds; which is lately return'd to a proſ-

a proſperous Condition, and having ſuffer'd with the *Crown* in its Misfortunes, does now partake of the happy Fruits of its *Reſtoration.*

Nor will *Experimental Philoſophy* be unthankful for the Aſſiſtance it ſhall receive: For it will enable us to provide beforehand, againſt any Alterations in *Religious Affairs*, which this *Age* may produce. If we compare the Changes to which *Religion* has been always ſubject, with the preſent face of Things, we may ſafely conclude, That whatever Viciſſitude ſhall happen about it in our time, it will probably neither be to the Advantage of *implicit Faith*, nor of *Enthuſiaſm*, but of *Reaſon.* The Fierceneſs of *violent Inſpirations* is in good meaſure departed: The Remains of it will be ſoon chas'd out of the World, by the remembrance of the terrible Footſteps it has every where left behind it. And though the *Church of Rome* ſtill preſerves its Pomp, yet the real Authority of that too is apparently decaying. It firſt got, by degrees, into *Temporal Power*, by the means of its *Spiritual*; but now it only upholds ſome Shadow of the *Spiritual*, by the Strength of the *Temporal Dominion* it has obtain'd.

This is the preſent State of *Chriſtendom.* It is now impoſſible to ſpread the ſame Clouds over the World again: The univerſal Diſpoſition of this *Age* is bent upon a *rational Religion:* And therefore I renew my affectionate Requeſt, that the *Church of England* would provide to have the chief Share in its firſt Adventure; that it would perſiſt, as it has begun, to incourage *Experiments*, which will be to our *Church* as the *Britiſh Oak* is to our *Empire*, an Ornament, and Defence to the Soil wherein it is planted.

Thus I have finiſh'd what I intended concerning *Religion:* wherein I deſire it might not be thought that

that I have defended every particular *Searcher* into *Nature*. That could not be justly expected from me; for there is no Man that makes an *Apology* for any general way, who will take upon him to make good all the Actions of all private Men who profess it. It is enough for my Purpose, if it shall be granted, that however some *Experimenters* may be inclinable to Irreligion; yet this rather proceeds from their own *Genius*, than from any Corruption that could be contracted from these *Studies*; and that if the same Men had profes's'd *Physic*, or *Law*, or even *Divinity* itself, they would have been in like manner disaffected towards heavenly Things.

I cannot deny, but that some *Philosophers*, by their Carelessness of a future Estate, have brought a Discredit on *Knowledge* itself: But what Condition of Men is free from such Accusations? Or why must we strait believe that their Impiety proceeds from their *Philosophy?* It is easy for Men to fall into gross Errors, and to mistake the wrong Causes for the true, in the Judgment which they make of others Opinions and Inclinations: When they behold them addicted to such or such Vices, and to have withal some good Qualities, in which they themselves do not excel, they presently are apt to imagine the *bad* to arise from the *good*, and so condemn both together; whereas perhaps it sprung from some other hidden Cause, of which they took no notice.

But let it be a true *Observation*, That many *Modern Naturalists* have been negligent in the *Worship of God*; yet perhaps they have been driven on this Prophaneness by the late extravagant Excesses of *Enthusiasm*. The infinite Pretences to *Inspiration*, and *immediate Communion with God*, that have abounded

in

in this *Age*, have carry'd several Men of Wit so far, as to reject the whole Matter; who would not have been so exorbitant, if the others had kept within more moderate Bounds. This is natural enough to be suppos'd; for so it has commonly happen'd, that the greatest Degrees of all *contrary Opinions* have met in the same *Age*, and have still heighten'd and increas'd each other.

From hence it may be gather'd, That the way to reduce a *real* and *sober* Sense of *Religion*, is not by endeavouring to cast a Veil of Darkness again over the Minds of Men; but chiefly by allaying the Violence of *spiritual Madness*: and that the one Extreme will decrease proportionably to the less'ning of the other.

It is apparent to all, That the Influence which *Christianity* once obtain'd on Mens Minds, is prodigiously decay'd. The Generality of *Christendom* is now well-nigh arriv'd at that fatal Condition, which did immediately precede the Destruction of the Worships of the ancient World; when the Face of *Religion* in their public *Assemblies*, was quite different from that Apprehension which Men had concerning it in private: In publick they observ'd its Rules with much Solemnity, but in private regarded it not at all. It is difficult to declare by what Means and Degrees we are come to this dangerous Point: But this is certain, that the *Spiritual Vices* of this *Age* have well-nigh contributed as much towards it, as the *Carnal*: And for these, the most efficacious *Remedy* that Man of himself can use, is not so much the sublime part of *Divinity* as its intelligible, and natural, and practicable *Doctrines*. The *Medicines* for *Religious Distempers* must be changeable according to the *Diseases*: And in this we

we may imitate *Christ* himself in his Method of healing Mens Bodies: Some Cures he perform'd by his Voice, some by Prayer, but some by the touch of his Hands, and even by his Spittle mingled with Earth. In a gross and sensual *Age*, the deepest Mysteries of our *Religion* may be proper to purify the Stupidity of Mens Spirits; but there must be an Application of quite different and more sensible Prescriptions, in a subtile, refined, and enthusiastical Time.

Such is the present Humour of the *World*; and such must be the Course of its Cure. Men must now be told, that as *Religion* is a *heavenly Thing*, so it is not utterly averse from making use of the Rules of *Human Prudence:* They must be inform'd, that the *true Holiness* is a Severity over our selves, and not others: They must be instructed, that it is not the best Service that can be done to *Christianity*, to place its chief Precepts so much out of the Way, as to make them unfit for Men of Business. They must remember, that the chief of the *Apostles became all Things to all Men, that he might gain some.* But above all, there must be Caution given, that Men do not strive to make themselves, and their own Opinions, ador'd, while they only seem zealous for the Honour of *God.* This is a Fault which is very incident to Men of *Devotion*; for when they have once form'd in themselves a *perfect Model* of the *Will of God*, and have long confirm'd their Minds by continual thinking upon it, they are apt to contemn all others that agree not with them in some Particulars. Upon this, they have strait the reproachful Term of *Atheists* to cast upon them; which tho' it be a Title that ought only to be employ'd against the bold and insolent Defiers of *Heaven* in their *Words* and *Actions*, yet it is too frequently us'd to express

the Malice of any eager and cenſorious Spirit, that has the Confidence to object it.

This, and all other the like *Principles* of *Uncharitableneſs*, are to be oppos'd by aſſerting the Duties of the *Law* of *Nature*, by the uſe of paſt and preſent *Times*, by the *Analogy* of human things, by *Moral* Virtue, by the Offices of *Society*, by the Contemplation of *God's viſible Works*, and ſuch eaſy and rational *Arguments*. Next to the Succour of *Divine Power*, this is the moſt probable way to preſerve the *Chriſtian Faith* amongſt us; if *God* has not in his Wrath reſolved to tranſplant it into ſome other quarter of the *Earth*, which has not ſo much neglected his Goodneſs. This indeed were a Revolution, which cannot be thought on without Horror. The Subverſion of all *Europe* would attend it. The Departure of the *Chriſtian Profeſſion* would be accompanied with as frightful Effects, as thoſe which follow'd on the Death of its *Founder*; when the *Heavens* were darken'd, the *Temple* ſhook, the Vail was rent, the Earth trembled, and the *Philoſopher* had reaſon to cry out, *That either Nature was diſſolving, or the God of Nature dying.*

§. XXIV. *Experiments advantageous to Manual Arts.*

I will now enter on the next Member of my *Diviſion*, to conſider the Purpoſe of the *Royal Society*, and the probable Effects of *Experiments*, in reſpect of all the *Manual Trades* which have been heretofore found out and adorn'd. And I will diſpatch this *Argument* in the Reſolution of theſe four Queſtions.

Whether the *Mechanic Arts* are ſtill improveable by human *Induſtry*:

Whether it be likely, that they may be advanc'd by any others, beſides the *Mechanic Artiſts* themſelves?

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Whether there be any ground of hope from *Experiments*, towards this Work?

And whether if ſuch *Arts* ſhall hereby happen to multiply, they will not ruin thoſe *Trades* that are already ſettled.

If in theſe Particulars I ſhall anſwer my Readers Doubts, I truſt it will be granted me, that it is not a vain or impoſſible Deſign, to endeavour the increaſe of *Mechanic Contrivances*; that the Enterprize is proper for a mixt *Aſſembly*; that the Courſe which they obſerve towards it will be effectual; and that the increaſe of ſuch *Operations* will be inoffenſive to others of the ſame kind, that have been formerly diſcover'd.

Before I examine theſe ſeveral *Heads* apart, perhaps it will not be an impertinent Labour, to take one general Survey of the principal Degrees and Occaſions, by which the ſeveral *Manufactures* have riſen, which beautify the face of the *Earth*, and have brought forth ſo much Pleaſure and Plenty amongſt Men.

The firſt of all human Race, when they were diſpers'd into ſeveral Lands, were at firſt ſuſtain'd by the *Fruits* of the *Earth*, which fell to their Share. Theſe at firſt they cheriſh'd, and us'd, not by any *Rules* of *Art*, but by that natural *Sagacity*, which teaches all Men to endeavour their own Preſervation. For the peaceable Enjoyment of theſe, they combin'd into Families, and little Leagues, which were the Beginnings of *Civil Government*. But finding that all Places did not bring forth all Things for Cloathing, Food, and Defence, they either violently ſeiz'd on what their Neighbours poſſeſs'd, or elſe they fairly agreed on a *mutual Exchange* of the Productions of their Soils. This Traffick was at firſt made in Kind;

and the *Fruits* that were thus barter'd, were either ſpent, or planted in other Grounds. By this means Mankind was maintain'd; and ſeveral *Earths* were furniſh'd by *Labour*, with what *Nature* beſtow'd not upon them. For this *Commutation* of their *Fruits*, and of the rude Effects of their firſt Induſtry, they began to deviſe the Conveniencies of *Carriage* by Land and Water; and to make it ſtill eaſier, and larger, they agreed on ſome common Things, to be the univerſal Standard of *Value* and *Price*; whence aroſe the uſe of *Money*.

This was the firſt Original of *Trade*, which from a narrow Commerce between the Hills, the Valleys, the Woods, the Plains, and the Rivers that border'd one upon another, is ſince extended to the whole Compaſs of the *Earth*. For in courſe of Time, the ſmall Clans, and natural Commonwealths were devour'd by the Strength of the greater; or elſe ſome of the wiſer Men reduc'd the rude Multitude into one Place, and perſwaded them to live quietly under the *Laws*. From thence Mankind began to have the face of *Civility*, which aroſe at firſt, by that which is the beſt Means of preſerving it now, by the *greatneſs* and *enlargement* of *Dominion*.

The firſt, all the Differences of *Living*, and the Advantages of *Strength* and *Empire*, did ſhew themſelves. Then ſome took on them to *Rule*, ſome to Aſſiſt, or Council thoſe that Rul'd, and ſome were forc'd to be ſubject to their Power. Thus the *Riches* and *Dominion* that were at firſt in common, were unequally divided: The Great, the Wiſe, or the Strong, obtain'd a principal Share; and either perſuaded, or conſtrain'd all the reſt to ſerve them with their Bodies. Thence ſprung all the *Arts* of *Convenience*

*ence* and *Pleaſure*, while the one part of Men would not be content to live according to the firſt Plainneſs of *Nature*: And the other were compell'd to work with their Hands, for the Eaſe and Pleaſure of their *Maſters Lives*, and the Support of their own. From theſe Beginnings the Inventions of *Peace* and *War*, the Delights of *Cities* and *Palaces*, the Delicacies of *Food*, the Curioſities of *Cloathing*, the Varieties of *Recreations* took their Riſe: And theſe have ſtill continued to increaſe, either by ſome caſual Diſcoveries, or by Luxury, or elſe as Men have been driven by ſome new Neceſſities, to paſs on farther to attempt new ways of maintaining themſelves.

Sect. XXV. *The Manual Arts are ſtill improveable.*

THIS is the moſt *natural Method* of the Foundation and Progreſs of *Manual Arts*. And they may ſtill be advanc'd to a higher Perfection, than they have yet obtain'd, either by the Diſcovery of new *Matter*, to imploy Mens Hands, or by a new *Tranſplantation* of the ſame *Matter*, or by handling the old Subjects of *Manufactures* after a new way, in the ſame Places.

And firſt, we have reaſon to expect, that there may ſtill ariſe new *Matter* to be manag'd by *Human Art* and *Diligence*; and that from the parts of the *Earth* that are yet unknown, or from the new diſcover'd *America*, or from our own Seas and Land, that have been long ſearch'd into, and inhabited.

*Firſt by new Matter from new Lands.*

If ever any more *Countries*, which are now hidden from us, ſhall be reveal'd, it is not to be queſtion'd, but there will be alſo opened to our *Obſervation*, very many kinds of *living Creatures*, of *Minerals*, of *Plants*, nay, of *Handicrafts*, with which we have been hitherto unacquainted. This may well be expected, if we remember, that there was never yet any

*Land*

*Land* discover'd, which has not given us divers new sorts of *Animals*, and *Fruits* of different Features and Shapes, and Virtues from our own, or has not supplied us with some new artificial *Engine*, and *Contrivance*.

And that our *Discoveries* may still be inlarg'd to farther *Countries*, it is a good Proof, that so many spacious Shores and Mountains, and Promontories, appear to our *Southern* and *Northern Sailors*; of which we have yet no Account, but only such as could be taken by a remote Prospect at Sea. From whence, and from the Figure of the *Earth*, it may be concluded, that almost as much space of Ground remains still in the *Dark*, as was fully known in the times of the *Assyrian* or *Persian Monarchy*. So that without assuming the vain prophetick Spirit, which I lately condemn'd, we may foretel, that the *Discovery* of another *new World* is still behind.

To accomplish this, there is only wanting the *Invention of Longitude*, which cannot now be far off, seeing it is generally allow'd to be feasible, seeing so many Rewards are ready to be heap'd on the *Inventors*; and (I will also add) seeing the *Royal Society* has taken it into its peculiar care. This, if it shall be once accomplish'd, will make well-nigh as much alteration in the World, as the Invention of the *Needle* did before: And then our Posterity may outgo us, as much as we can travel farther than the *Antients*; whose *Demy Gods* and *Heroes* did esteem it one of their chief Exploits, to make a Journey as far as the *Pillars of Hercules*. Whoever shall think this to be a desperate Business, they can only use the same *Arguments*, wherewith *Columbus* was at first made ridiculous, if he had been discourag'd by the Raillery of his

his Adverſaries, by the Judgment of moſt *Aſtronomers* of his time, and even by the Intreaties of his own *Companions*; but three Days before he had a ſight of *Land*, we had loſt the Knowledge of half the *World* at once.

§. XXVI. *Mechanics improveable by new Matter from America.*

AND as for the new diſcover'd *America*, 'tis true, that has not been altogether uſeleſs to the *Mechanic Arts:* But ſtill we may gueſs, that much more of its Bounty is to come, if we conſider, that it has not yet been ſhewn above *two hundred Years*; which is ſcarce enough time to travel it over, deſcribe, and meaſure it, much leſs to pierce into all its Secrets. Beſides this, a good part of this Space was ſpent in the *Conqueſt* and *ſettling* the *Spaniſh Government*, which is a Seaſon improper for *Philoſophical Diſcoveries*. To this may be added, that the chief Deſign of the *Spaniards* thither, has been the Tranſportation of *Bullion*; which being ſo profitable, they may well be thought to have overſeen many other of its *Native Riches*. But above all, let us reflect on the Temper of the *Spaniards* themſelves: They ſuffer no Strangers to arrive there: they permit not the *Natives* to know more than becomes their Slaves. And how unfit the *Spaniſh* humour is to improve *Manufactures*, in a Country ſo diſtant as the *Weſt-Indies*, we may learn by their Practice in *Spain* itſelf, where they commonly diſdain to exerciſe any *Manual Crafts*, and permit the Profit of them to be carried away by Strangers.

From all this we may make this *Concluſion*, That if ever that vaſt Tract of *Ground* ſhall come to be more familiar to *Europe*, either by a *free Trade*, or by *Conqueſt*, or by any other *Revolution* in its Civil Affairs, *America* will appear quite a new Thing to us; and

and many furniſh us with an abundance of *Rarities*, both Natural and Artificial; of which we have been almoſt as much depriv'd by its preſent *Maſters*, as if it had ſtill remain'd a part of the *unknown World*.

§. XXVII. *By new Matter from the World.*

But laſtly, to come nearer home, we have no ground to deſpair, but very much more *Matter*, which has been yet unhandled, may ſtill be brought to light, even in the moſt civil and moſt peopled Countries; whoſe *Lands* have been thoroughly meaſur'd by the Hands of the moſt *exact Surveyors*; whoſe underground *Riches* have been accurately pry'd into; whoſe Cities, Iſlands, Rivers, and Provinces, have been deſcrib'd by the Labours of *Geographers*. It is not to be doubted, but ſtill there may be an infinite number of *Creatures* over our Heads, round about us, and under our Feet, in the large Space of the *Air*, in the Caverns of the *Earth*, in the Bowels of *Mountains*, in the Bottom of *Seas*, and in the Shades of *Foreſts*, which have hitherto eſcap'd all *mortal Senſes*. In this the *Microſcope* alone is enough to ſilence all Oppoſers. Before that was invented, the chief help that was given to the Eyes by *Glaſſes*, was only to ſtrengthen the dim Sight of old *Age*; but now by the means of that excellent *Inſtrument*, we have a far greater Number of different kinds of Things reveal'd to us, than were contain'd in the viſible Univerſe before; and even this is not yet brought to *Perfection*: The chief Labours that are publiſh'd in this way, have been the *Obſervations* of ſome *Fellows* of the *Royal Society*, nor have they as yet apply'd it to all Subjects, nor tried it in all Materials and Figures of *Glaſs*.

To the *Eyes* therefore there may ſtill be given a vaſt addition of *Objects*: And proportionably to all

all the other Senſes. This Mr. *Hook* has undertaken to make out, that *Taſting*, *Touching*, *Smelling*, and *Hearing*, are as improveable as the *Sight*; and from his excellent *Performances* in the one, we may well rely on his *Promiſe* in all the reſt.

§ XXVIII. *Mechanics improveable by Tranſplantations.*

The next *Encreaſe* of *Manual Arts* which is probable to ſucceed, may happen by the farther *Tranſplanting* and *Communicating* of the ſeveral *Natural Commodities* of all *Nations*, to other *Airs*, and other *Soils*, and other ways of *Cultivation*. That this is not yet finiſh'd, is evident, in that there is no *Land* ſo well furniſh'd as to produce all the various ſorts of Things, which its Ground and Temperature is capable to receive; and alſo, becauſe many of the moſt fertile *Countries* contain large Spaces that are utterly Barren.

This *Work* then may be farther advanc'd, by three kinds of Endeavours.

The firſt by *Tranſplanting* out of one Land into another, of the ſame Situation in reſpect of the *Heavens*. This may be try'd by conveying the Eaſtern *Spices*, and other uſeful *Vegetables*, into our Weſtern *Plantations*. Nor can it be imagin'd, why they ſhould thrive in one *Indies*, and not in the other; why the *Soil* ſhould not be as good where the *Sun ſets*, as where it *riſes*; ſeeing there are parts of both, which lie under the ſame Influence of that, and the other *Celeſtial Bodies*, to whoſe kindly Heat and Neighbourhood, the *Oriental Nations* are ſuppos'd to owe their Advantages. This alſo may be attempted in our *Northern Climates*. As for Inſtance, the *Flax*, of which we ſtand ſo much in need, may proſper in *Ireland*, in many vaſt Tracts of Ground, now only poſſeſſed by wild *Beaſts*, or *Tories* almoſt as wild.

The second *Advancement* of this *Work* may be accomplish'd, by carrying and transplanting *living Creatures* and *Vegetables* from one Climate to another. This will be very beneficial, though it will be performed with a various Success. Sometimes the *Soil* and the *Air* being chang'd, will give a new Force to the new *Guests*; as the *Arabian Horse*, by mingling with our *Breed*, produces a more serviceable *Race* than either of them single. And sometimes the Alteration will be for the worse; as the Vine of *France* brought into *England*, and the *Horses* and *Dogs* of *England* into *France*; both of which are found to degenerate exceedingly: Their *Soil* and their *Sun*, it seems, being fitter to produce Things of *Pleasure* and *Delight*; and our *Air* and our *Earth* being more proper to beget *Valour* and *Strength*.

The third way of *Communication* to be try'd, is by removing the *Plants* and the Productions of the same Country from one part of it into another; and by practising every where all the sorts of *Husbandry*, which are us'd in some Places with Success. That this is not enough perfected even in *England*, is manifest to every one that beholds the *Kentish* Orchards, and the *Herefordshire* Hedges; which seem to upbraid the laziness of other Countries, whose High-ways are only fenc'd with Thorns and Briars, or at the best with Hazel; while theirs are beautify'd with Apples, Pears, and Cherries.

Now then, in every one of these *Transplantations*, the chief Progress that has hitherto been made, has been rather for the *Collection* of *Curiosities* to adorn *Cabinets* and *Gardens*, than for the Solidity of *Philosophical Discoveries*: Yet there may be a prodigious Advantage made in them all, both for the one end and

the

the other. And in this it will be found, as in many other Things, that if Men only intend a little *Curiosity* and *Delight*, they will reap not much more by their Pains: But if they regard real Use, not only the *Profit*, but a greater *Delight* will also follow thereon.

And for our *Encouragement*, whatever Attempts of this Nature have succeeded, they have redounded to the great Advantage of the *Undertakers*. The *Orange* of *China* being of late brought into *Portugal*, has drawn a great *Revenue* every Year from *London* alone. The Vine of the *Rhine* taking Root in the *Canaries*, has produc'd a far more delicious Juice, and has made the Rocks and the Sun-burnt Ashes of those Islands, one of the richest Spots of Ground in the *World*. And I will also instance in that which is now in a good Forwardness; *Virginia* has already given *Silk* for the Cloathing of our *King*; and it may happen hereafter to give Cloaths to a great part of *Europe*, and a vast Treasure to our *Kings*: if the *Silk-worms* shall thrive there (of which there seems to be no doubt) the Profit will be inexpressible. We may guess at it, by considering what Numbers of *Caravans*, and how many great Cities in *Persia* are maintain'd by that *Manufacture* alone, and what mighty Customs it yearly brings into the *Sophi's Revenue*.

§. XXIX. *Mechanics improveable by the old Matter of Arts.*

But if both these Helps should chance to fail; if nothing *new* should ever come into our Hands; and if there could be no farther Alteration made by *Transplanting*; yet we may still take Comfort, and rely on the *old Matter* itself, on which all our present *Arts* have been devised. This certainly will take away all distrust in this Business: For it may be observ'd, that the greatest part of all our *New Inventions* have not

been raiſed from Subjects before untouch'd (though they alſo have given us very many) but from the moſt ſtudied and moſt familiar Things, that have been always in Mens Hands and Eyes. For this I ſhall only inſtance in *Printing*, in the *Circulation of the Blood*, in Mr. *Boyle*'s Engine for the ſucking out of *Air*, in the making of *Guns*, in the *Microſcopical Glaſſes*, and in the *Pendulum Clocks* of *Hugenius*. What might we have believ'd to be perfect, if not the *Art* of Mens *Communicating* their Thoughts one to another? What was nearer to them than their *Blood*, by which their Life ſubſiſts? And what more ready to be found out than its *Motion*? In what Subject had the Wit of *Artificers* been more ſhewn, than in the variety of *Clocks* and *Watches*? What Thing was more in Mens View than *Glaſs*, through which, in theſe Countries, the very Light itſelf is admitted, whereby we diſcern all Things elſe? What more natural to us than the *Air* we breath, with which we form every word to expreſs other Things? What was more ſtudied than the *Art of Fighting*? What little *Stratagem*, or *Fortification*, or *Weapon*, could one have thought to have been conceal'd from the *Greeks* and *Romans*, who were ſo curious in the *Diſcipline* of War? And yet in all theſe the moſt obvious Things, the greateſt Changes have been made by late *Diſcoveries*; which cannot but convince us, that many more are ſtill to come from Things that are as common, if we ſhall not be wanting to ourſelves.

§. XXX. *Mechanics improveable by the ſpreading of Civility.*

And this we have good reaſon to truſt will be effected, if this *Mechanic Genius*, which now prevails in theſe Parts of *Chriſtendom*, ſhall happen to ſpread wider amongſt ourſelves, and other *Civil Nations*;

or

or if by ſome good Fate it ſhall paſs farther on to other Countries that were yet never fully civiliz'd. We now behold much of the Northern Coaſts of *Europe* and *Aſia*, and almoſt all *Afric*, to continue in the rude State of *Nature*: I wiſh I had not an Inſtance nearer Home, and that I did not find ſome Parts of our own *Monarchy* in as bad a Condition. But why may we not ſuppoſe, that all theſe may in courſe of Time be brought to lay aſide the untam'd Wildneſs of their preſent Manners? Why ſhould we uſe them ſo cruelly as to believe, that the Goodneſs of their *Creator* has not alſo appointed them their Seaſon of polite and happy Life, as well as us? Is this more unlikely to happen, than the Change that has been made in the *World* theſe laſt ſeventeen hundred Years? This has been ſo remarkable, that if *Ariſtotle*, and *Plato*, and *Demoſthenes*, ſhould now ariſe in *Greece* again, they would ſtand amaz'd at the horrible Devaſtation of that which was the *Mother of Arts*. And if *Cæſar* and *Tacitus* ſhould return to Life, they would ſcarce believe this *Britain*, and *Gaul*, and *Germany*, to be the ſame which they deſcrib'd: They would now behold them cover'd over with *Cities* and *Palaces*, which were then over-run with *Foreſts* and *Thickets*: They would ſee all manner of *Arts* flouriſhing in theſe Countries, where the chief *Art* that was practis'd in their Time, was that barbarous one of *painting their Bodies*, to make them look more terrible in *Battle*.

This then being imagin'd, that there may ſome lucky Tide of *Civility* flow into thoſe *Lands*, which are yet ſavage, there will a double Improvement thence ariſe, both in reſpect of ourſelves and them: For even the preſent *skilful* Parts of Mankind, will be thereby made more *skilful*; and the other will not only

only increaſe thoſe *Arts* which we ſhall beſtow upon them, but will alſo venture on new Searches themſelves.

If any ſhall doubt of the firſt of theſe *Advantages*, let them conſider that the ſpreading of *Knowledge* wider, does beget a higher and a clearer *Genius* in thoſe that enjoy'd it before.

But the chief Benefit will ariſe from the *New Converts*; for they will not only receive from us our *Old Arts*, but in their firſt Vigour will proceed to *new ones* that were not thought of before. This is reaſonable enough to be granted: For ſeeing they come freſh and unwearied, and the Thoughts of Men being moſt violent in the firſt opening of their *Fancies*; it is probable they will ſoon paſs over thoſe Difficulties about which theſe People, that have been long *Civil*, are already tir'd. To this Purpoſe I might give as many *Examples* as there have been different *Periods* of *civilizing*; that thoſe *Nations* which have been taught, have prov'd wiſer and more dextrous than their *Teachers*. The *Greeks* took their firſt Hints from the *Eaſt*; but out-did them in *Muſic*, in *Statuary*, in *Graving*, in *Limning*, in *Navigation*, in *Horſemanſhip*, in *Husbandry*, as much as the *Ægyptians* or *Aſſyrians* exceed their unskilful *Anceſtors* in *Architecture*, *Aſtronomy*, or *Geometry*. The *Germans*, the *French*, the *Britains*, the *Spaniards*, the modern *Italians*, had their Light from the *Romans*; but ſurpaſs'd them in moſt of their own *Arts*, and well-nigh doubled the ancient Stock of *Trades* deliver'd to their keeping.

§. XXXI. *Mechanics are improveable by others beſides Tradeſmen.*

So then, the whole *Prize* is not yet taken out of our Hands: The *Mechanic Invention* is not quite worn away, nor will be, as long as new Subjects may be diſcovered, as long as our old Materials may be alter'd

or

or improv'd, and as long as there remains any Corner of the *World* without *Civility*. Let us next observe, whether Men of different ways of Life are capable of performing any Thing towards it, besides the *Artificers* themselves. This will quickly appear undeniable, if we will be convinc'd by *Instances*; for it is evident, that diverse sorts of *Manufactures* have been given us by Men who were not bred up in *Trades* that resembled those which they discovered. I shall mention Three; that of *Printing*, *Powder*, and the *Bow-Dye*. The *admirable Art of Composing Letters*, was so far from being started by a Man of *Learning*, that it was the Device of a Soldier: And *Powder* (to make Recompence) was invented by a *Monk*, whose course of Life was most averse from handling the *Materials* of *War*. The ancient *Tyrian Purple* was brought to light by a *Fisher*; and if ever it shall be recover'd, it is likely to be done by some such Accident. The *Scarlet* of the *Moderns* is a very beautiful Colour; and it was the Production of a *Chymist*, and not of a *Dyer*.

And indeed the *Instances* of this kind are so numerous, that I dare in general affirm, That those Men who are not peculiarly conversant about any one sort of *Arts*, may often find out their *Rarities* and *Curiosities* sooner, than those who have their Minds confin'd wholly to them. If we weigh the *Reasons* why this is probable, it will not be found so much a *Paradox*, as perhaps it seems at the first Reading. The *Tradesmen* themselves, having had their Hands directed from their Youth in the same *Methods of Working*, cannot when they please so easily alter their Custom, and turn themselves into new Roads of Practice. Besides this, they chiefly labour for present Livelihood, and therefore cannot

cannot defer their *Expectations* so long, as is commonly requisite for the ripening of any *new Contrivance*. But especially having long handled their *Instruments* in the same Fashion, and regarded their *Materials* with the same Thoughts, they are not apt to be surpriz'd much with them, nor to have any extraordinary *Fancies*, or *Raptures* about them.

These are the usual Defects of the *Artificers* themselves: Whereas the Men of freer Lives, have all the contrary Advantages: They do not approach those *Trades*, as their dull and unavoidable, and perpetual *Employments*, but as their *Diversions*: They come to try those *Operations*, in which they are not very exact, and so will be more frequently subject to commit Errors in their Proceeding: Which very Faults and Wandrings, will often guide them into new *Light*, and new *Conceptions*: And lastly, there is also some Privilege to be allow'd to the *Generosity* of their *Spirits*, which have not been subdu'd, and clogg'd by any constant *Toil*, as the others. *Invention* is an *Heroic* Thing, and plac'd above the reach of a low and vulgar *Genius*: It requires an active, a bold, a nimble, a restless *Mind*: A thousand Difficulties must be contemn'd, with which a mean Heart would be broken; many *Attempts* must be made to no Purpose; much *Treasure* must sometimes be scatter'd without any Return; much Violence and Vigour of Thoughts must attend it; some Irregularities and Excesses must be granted it, that would hardly be pardon'd by the severe *Rules of Prudence*. All which may persuade us, that a large and an unbounded Mind is likely to be the *Author* of greater *Productions*, than the calm, obscure, and fetter'd Endeavours of the *Mechanics* themselves: And that as in the *Generation of Children*, those are usually

observ'd

obſerved to be moſt ſprightly, that are the ſtolen Fruits of an unlawful *Bed*; ſo in the Generations of the *Brains*, thoſe are often the moſt vigorous and witty, which Men beget on other *Arts*, and not on their own.

§. XXXII. *Mechanics beſt improvable by Experiments.*

THIS came ſeaſonably in, to ſtop the undeſerv'd Clamours, which perhaps in this humorous *Age*, ſome *Tradeſmen* may raiſe againſt the *Royal Society*, for entring within the Compaſs of their Territories. Wherefore I proceed to my third *Particular*, which I have aim'd at in the two former, *that the ſureſt Increaſe remaining to be made in Manual Arts, is to be perform'd by the conduct of Experimental Philoſophy.* This will appear undeniable when we ſhall have found, that all other Cauſes of ſuch *Inventions* are *defective*; and that for this very Reaſon, becauſe the *Trials of Art*, have been ſo little united with the plain Labours of Mens Hands.

I have already given this Account of the former *Arts* that we uſe, that the greateſt Part of them has been produc'd, either by *Luxury*, or *Chance*, or *Neceſſity*; all which muſt be confeſs'd to be mean and ignoble Cauſes of the *Rational Mechanics*.

The firſt of theſe has been, that Vanity and Intemperance of Life, which the delights of *Peace*, and greatneſs of *Empire* have always introduc'd. This has been the Original of very many extravagant *Inventions* of *Pleaſure*; to whoſe *Promotion*, it is not requiſite that we ſhould give any help, ſeeing they are already too exceſſive. And indeed, if we conſider the vaſt Number of the *Arts* of *Luxury*, compar'd to the ſound, and the ſubſtantial ones of uſe; we ſhall find that the Wit of Men has been as much defective in

the one, as redundant in the other. It has been the conſtant Errors of Mens Labours in all *Ages*, that they have ſtill directed them to improve thoſe of *Pleaſure*, more than thoſe of *Profit*. How many, and how extravagant, have been the *Ornaments* about *Coaches*? And how few *Inventions*, about new Frames for *Coaches*, of about *Carts*, and *Ploughs*? What prodigious Expence has been thrown away, about the Faſhions of *Cloaths*? But how little endeavours have there been to invent new *Materials* for *Cloathing*, or to perfect thoſe we have? The *Furniture* and *Magnificence* of *Houſes*, is riſen to a wonderful Beauty within our Memory: But few or none have throughly ſtudied the well-ordering of *Timber*, the hardning of *Stone*, the improvement of *Mortar*, and the making of better *Bricks*. The like may be ſhewn in all the reſt: wherein the ſolid *Inventions* are wont to be overwhelm'd by *Gawdineſs* and *Superfluity*; which Vanity has been caus'd by this, that the *Artiſts* have chiefly been guided by the Fancies of the Rich, or the Young, or of vain *Humoriſts*, and not by the *Rules* and *Judgments* of Men of *Knowledge*.

The ſecond occaſion that has given help to the Increaſe of *Mechanics* has been *Chance*: For in all Ages, by ſome caſual Accidents, thoſe Things have been reveal'd, which either Men did not think of, or elſe ſought for in vain. But of this the *Benevolence* is irregular, and moſt uncertain: This indeed can ſcarce be ſtyl'd the *Work* of a Man. The *Hart* deſerves as much praiſe of *Invention*, for lighting on the Herb, that cures it; as the Man who blindly ſtumbles on any profitable *Work*, without Foreſight or Conſideration.

The laſt that I ſhall alledge is *Neceſſity*. This has given riſe to many great *Enterprizes*; and like the cruel

cruel Step-mother of *Hercules*, has driven Men upon *Heroic Actions*, not out of any tender Affection, but hard Uſage. Nor has it only been an excellent Miſtreſs to particular Men, but even to whole *States* and *Kingdoms*; for which reaſon ſome have preferr'd a *Barren Soil*, for the Seat of an *Imperial City*, before a *Fruitful*; becauſe thereby the Inhabitants being compell'd to take Pains, and to live induſtriouſly, will be ſecure from the dangerous Inchantments of *Plenty* and *Eaſe*; which are fatal to the Beginnings of all Commonwealths. Yet the Defects of this ſevere *Author* of great *Works*, are very many. It often indeed engages Men in brave Attempts, but ſeldom carries them on to finiſh what they begin: It labours at firſt for want of *Bread*; and that being obtain'd it commonly gives over: It rather ſharpens than enlarges Mens *Wits*; it ſooner puts them upon ſmall *Shifts*, than great *Deſigns*; it ſeldom riſes to high or magnanimous Things; for the ſame neceſſity which makes Men *inventive*, does commonly depreſs and fetter their *Inventions*.

And now theſe principal Cauſes of *Mechanic Diſcoveries* being found for the greateſt part to be either corrupt or weak: It is but juſt, that *Reaſon* itſelf ſhould interpoſe, and have ſome Place allow'd it in thoſe *Arts*, which ought to be the chief *Works* of *Reaſon*. It is a ſhame to the Dignity of *human Nature* itſelf, that either Mens Luſts ſhould tempt them, or their Neceſſities drive them, or blind Fortune ſhould lead them in the dark, into thoſe Things in which conſiſts the chief *Prerogative* of their Condition. What greater *Privilege* have Men to boaſt of than this; that they have the Pow'r of uſing, directing, changing, or advancing all the reſt of the Creatures? This is the

*Dominion* which *God* has given us over the *Works* of his Hands. And if we will either answer the Expectations of *Heaven*, or deserve so high an Honour, we ought rather to manage this *Dominion* by *Diligence* and *Counsel*, than by *Chance*, or *Luxury*, or *Compulsion*.

It is impossible for us to administer this *Power* aright, unless we prefer the Light of Men of *Knowledge*, to be a constant Overseer and Director of the *Industry* and *Works* of those that labour. The Benefits are vast, that will appear upon this Conjunction. By this means the *Inventions* of *Chance* will be spread into all their various Uses, and multiply'd into many new Advantages: By this the *Productions* of *Necessity* will be amplify'd and compleated: By this those of *Luxury* and *Wantonness* may be reduc'd to some solid Ends: By this may be rais'd almost as certain a Method to invent new *Mechanics*, as now any particular *Mechanics* can practise, to produce their own *Operations*; by this the weak Minds of the *Artists* themselves will be strengthen'd, their low Conceptions advanc'd, and the Obscurity of their Shops enlighten'd: By this their Thoughts will be directed to better *Instruments* and *Materials*; by this their *Poverty* will be assisted, and they will be enabled to attempt more costly *Trials*; by this that will be amended, which has been hitherto the Misfortune of such *Inventions*, that they have commonly fallen into Mens Hands, who understand not their *Natures*, *Uses*, or *Improvements*: By this the Conceptions of Men of *Knowledge*, which are wont to soar too high, will be made to descend into the *material World*; and the flegmatick Imaginations of Men of *Trade*, which use to grovel too much on the Ground, will be exalted.

It was said of *Civil Government* by *Plato*, that then the World will be best rul'd, when either *Philosophers* shall be chosen *Kings*, or *Kings* shall have *Philosophical* Minds. And I will affirm the like of *Philosophy*; it will then attain to Perfection, when either the *Mechanic Labourers* shall have *Philosophical Heads*, or the *Philosophers* shall have *Mechanical Hands*; for the proof of this I need only propose one Instance, with which I am furnish'd by *Antiquity*; and it is of *Archimedes*; by this Example alone, we may at once chastise the sloth of all *Ages* since his time, and confute the present Contemners of *Mechanic Knowledge*. This *Great Man* was one of the first who apply'd his Skill, in the *Mathematics* and *Physics*, to the Practices and Motions of *Manual Trades*. And in these his Success was so prodigious, that the true Contrivances of his Hands did exceed all the *fabulous Strength*, which either the *ancient Stories*, or modern *Romances* have bestow'd on their *Heroes*. The *Weights* he mov'd were so vast, and the *Engines* he fram'd had such dreadful Effects, that his Force could neither be resisted by *Seas*, or *Mountains*, or *Fleets*, or *Armies*, which are the greatest Powers of Nature and Men. He alone sustain'd the Burden of his falling Country; he alone kept the *Romans* at a Bay, to whom the whole World was to yield. And perhaps he had come off victorious at last, if he had not contended with the fatal Valour of *Marcellus*: Amongst all whose Exploits, these are recorded as the two greatest, that he first shew'd that *Hannibal* might be subdu'd; and that he vanquish'd *Syracuse*, though it was defended by *Archimedes*.

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§. XXXIII. *The Invention of new Mechanicks will not injure the old.*

THUS far I hope the way is clear as I go: I have ſome Confidence that I have ſufficiently prov'd, that the *Invention* of *Trade* may ſtill proceed farther, and that by the help of Men of free Lives, and by this courſe of *Experiments*. But yet the main *Difficulty* continues unremov'd. This ariſes from the ſuſpicions of the *Tradeſmen* themſelves: They are generally infected with the narrowneſs that is natural to *Corporations*, which are wont to reſiſt all *new Comers*, as profeſs'd Enemies to their *Privileges:* And by theſe intereſted Men it may be objected, That the growth of *new Inventions* and *new Artificers*, will infallibly reduce all the old ones to Poverty and Decay.

But to take off theſe *Fears* in this Particular, they are to be inform'd, that there are two ſorts of *Experiments* which the *Royal Society* attempts in *Mechanical* Matters. The firſt will be employ'd about the reviſing, changing, and correcting of the old *Mechanics* themſelves: The ſecond, about inventing of New. In the firſt of theſe they can have no ground of Jealouſy; ſeeing they are not intended to bring others over their Heads, but only to beautify and faſten thoſe which they already enjoy. And even this is a Work ſo neceſſary to be done, that if there were not a continual Reparation made in them, they would ſoon languiſh, and inſenſibly conſume away into *Barbariſm:* For the *Arts* of Mens Hands are ſubject to the ſame Infirmity with *Empire*, the beſt *Art* of their Minds, of which it is truly obſerv'd, that whenever it comes to ſtand ſtill, and ceaſes to advance, it will ſoon go back and decreaſe.

Hence it appears, that one part of *Experiments*, and that a very conſiderable part, is free from their *Cavils*. Let us then go on to the other kinds, which Pur-

Purpoſe the ſtriking out of *new Mechanics:* Of theſe I will alſo aſſert the Innocence, in reſpect of their Predeceſſors. In few Words, the *Old Arts* are ſo far from being endanger'd by the *New*, that they themſelves will receive a proportionable *Increaſe*, as the *New* ſhall ariſe. The Warmth and Vigour which attends new *Diſcoveries*, is ſeldom wont to confine itſelf to its own Sphere, but is commonly extended farther to the Ornament of its Neighbours. This is apparent in the Degree by which all *Nations* uſe to attain to a higher *Civility*. The ordinary Method wherein this happens, is the Introduction of ſome one or two *New Arts:* For they appearing with great Activity in the Beginning, do not only eſtabliſh themſelves; but alſo by ſtirring and inflaming Mens Minds, by diſgracing the lazineſs of other *Artizans*, and provoking them to an Emulation, they are wont to bring an *univerſal Light* and *Beauty* on thoſe *Inventions* into whoſe Company they are brought.

It is ſaid of the *Moral Virtues*, that they have ſuch a mutual Dependance, that no Man can attain to *Perfection* in any one of them, without ſome Degree of the other. And this alſo is certain in the *Mechanic Arts:* The Connexion between them is ſo cloſe, that they generally uſe to increaſe in the ſame Meaſure. There is no Time, nor great City, which perfectly excels in any one of them, but it is thereby made more capable of admitting the reſt, or of advancing them higher if they were admitted before.

It is true indeed, the increaſe of *Tradeſmen* is an Injury to others, that are bred up in particular *Trades*, where there is no greater *Employment* than they can maſter: But there can never be an overcharge of

*Trades*

*Trades* themſelves. That Country is ſtill the richeſt and moſt powerful, which entertains moſt *Manufactures*. The Hands of Men employ'd are true *Riches*; the ſaving of thoſe Hands by Inventions of *Art*, and applying them to other *Works*, will increaſe thoſe *Riches*. Where this is done, there will never a ſufficient Matter for Profit be wanting; for if there be not vent for their Productions at Home, we ſhall have it Abroad; but where the Ways of Life are few, the Fountains of Profit will be poſſeſs'd by few; and ſo all the reſt muſt live in *Idleneſs*, on which inevitably enſues *Beggary*; whence it is manifeſt, that *Poverty* is caus'd by the fewneſs of *Trades*, and not by the multitude.

Nor is it enough to overthrow this, to tell us, that by this addition of *Labourers* all Things will become dearer, becauſe more muſt be maintained: For the high rate of Things is an Argument of the Flouriſhing, and the cheapneſs of the Scarcity of Money, and ill peopling of all Countries. The firſt is a ſign of many Inhabitants, which are true *Greatneſs:* The ſecond is only a fit Subject for *Poets* to deſcribe, and to compare to their *Golden Age*; for where all Things are without *Price* or *Value*, they will be without *Arts* or *Empire*, or *Strength*.

I will explain all this by a familiar and domeſtic *Inſtance*. It is probable that there are in *England* a hundred times more *Trades* than the *Saxons* or the *Danes* found here in their Invaſions; and withal the particular *Traders* live now more plentifully, and the whole Nation is wonderfully ſtronger than before. This alſo may be ſeen in every particular *City*: The greater it is, the more kinds of *Artificers* it contains; whoſe Neighbourhood and Number is ſo far from being

ing an hindrance to each others Gain, that ſtill the *Tradeſmen* of moſt populous Towns are wealthier than thoſe who profeſs the ſame Crafts in Country Mercats.

In *England* it has of late been a univerſal *Murmur*, that *Trade* decays; but the contrary is evident, from the perpetual Advancement of the *Cuſtoms*. Whence then ariſes the Complaint? From hence, that *Traders* have multiplied above the proportionable Increaſe of *Trades*: By this Means all the *old* Ways of Gain are over-ſtock'd, which would ſoon be prevented by a conſtant Addition of *new*.

The want of a right apprehending this, has always made the *Engliſh* averſe from admitting of new *Inventions*, and ſhorter Ways of Labour, and from naturalizing new People: both which are the fatal Miſtakes that have made the *Hollanders* exceed us in *Riches* and *Trafic*: they receive all *Projects* and all *People*, and have few or no *Poor*: We have kept them out and ſuppreſs'd them, for the Sake of the *Poor*, whom we thereby do certainly make the poorer.

And here there is ſuggeſted to me a juſt Occaſion of lamenting the ill *Treatment* which has been moſt commonly given to *Inventors*, not only here in *England*, but in all *Ages* and *Countries*. Nor do they only meet with rough Uſage from thoſe that envy their Honour; but even from the *Artificers* themſelves, for whoſe Sakes they labour: while thoſe that add ſome ſmall Matters to things begun, are uſually enrich'd thereby; the *Diſcoverers* themſelves have ſeldom found any other Entertainment than Contempt and Impoveriſhment. The Effects of their *Induſtry* are wont to be decry'd while they live: the Fruits of their *Studies* are frequently alienated from their Children;

the little *Tradesmen* conspire against them, and endeavour to stop the Springs from whence they themselves receive Nourishment: The common Titles with which they are wont to be defam'd, are those of *Cheats* and *Projectors*. I cannot deny but many such do often mingle themselves in the noble Throng of *great Inquirers*: as of old there were some that imitated *Philosophers* only in Beard and Austerity: So I grant at this time there may false *Experimenters* and *Inventors* arise, who will strive to make themselves admir'd by the loud talking of *Mathematical Engines*, and *Glasses*, and *Tools*; and by sounding in every Place such goodly Words as *Chymistry*, and *Agriculture*, and *Mechanics*. But though the Folly of such *Pretenders* cannot be avoided, we must not therefore reject the sober and the judicious *Observers*. It is better sometimes to indure Vanities, than out of too much Niceness to lose any real *Invention*. We ought to do with *Philosophical Works*, as *Ministers* of *State* with *Intelligence*. It is the wisest Course to give Incouragement to all, least by shewing ourselves too scrupulous of being impos'd on by *Falshoods*, we chance to be depriv'd of the *Knowledge* of some important *Truths*.

The next *Particular* which I resolv'd to handle, is the Advantage of *Experiments* in respect of *Physic*. On this I intended to dilate in many Words, both because of the great weight of the *Subject*, which concerns the very Welfare and Health of our Lives, and also because it would afford me abundant matter for Discourse; for certainly it were easy to prove that there may still a vast Progress be made in the true *Art* of *Medicine*, if either we consider the imperfection of the *Method* of the *ancient Physicians*; or if we observe the Nature of *Diseases*, which alter and multi-

multiply upon us every *Age*; or if we reflect on the *Cures* themselves, and how little the *Invention* of new ones has hitherto been regarded.

But as I was entring on this *Subject*, I perceiv'd that I might safely omit it, seeing it is already better perform'd by Mr. *Boyle*, in his Book of the *Usefulness of Experimental Philosophy*. I will therefore withdraw my Pen from this matter, which this noble Gentleman has manag'd in the best and most powerful Way, by using not only the Force of *Reason*, but the Conviction of particular *Instances*.

§. XXXIV. *Experiments a proper Study for the Gentlemen of our Nation.*

AND now with so good an *Omen* as this Gentleman's *Example*, who has not disdain'd to adorn the Honour of his *Family* with the *Studies* of *Nature*; I will go on to recommend them to the *Gentry* and *Nobility* of our *Nation*. And I am the more encourag'd to make this Address, because I behold that what I would advise is already in good measure accomplish'd; so that I shall not only have an Occasion to *exhort* them to proceed, but to commend them also, for their present Zeal towards these *Endeavours*.

In this indeed I have much reason to applaud the *generous Breeding* which has been given to the *Experimental Knowledge* of this *Age* and *Country*, above the base and contemptible *Education* of the Opinions of all former *Sects*: for now *Philosophy* being admitted into our *Exchange*, our *Church*, our *Palaces*, and our *Court*, has begun to keep the best Company, and refine its Fashion and Appearance, and to become the Employment of the *Rich*, and the *Great*, instead of being the Subject of their *Scorn*: Whereas it was of old for the most part only the Study of the *Sullen* and the *Poor*, who thought it the gravest Part of

*Science*, to contemn the uſe of Mankind, and to differ in *Habit* and *Manners* from all others, whom they ſlighted as Madmen and Fools. From this arrogant Sordidneſs of ſuch *Principles*, there could not be expected any *Magnificent Works*, but only ill-natur'd and contentious *Doctrines*. Whatever the *Poets* ſay of the *Moral Wiſdom*, that it thrives beſt in *Poverty*; it is certain the *Natural* cannot: for in ſuch mean and narrow Conditions, Men perhaps may learn to *deſpiſe* the World, but never to *know* it.

Now then, I will proceed not ſo much to exhort, as to confirm the *Gentlemen* of our *Nation*, in the proſecution of this *Art*, to which their *Purſes* and their *generous Labours* are moſt neceſſary. And for their incouragement in this way, I will briefly lay before them the Privileges they have for ſuch *Inquiries*, above all the *Gentry* of our Neighbour *Nations*, and above all the *Nobility* of former *Ages* in this *Kingdom*.

One principal Help that they enjoy, for the promoting of theſe *Studies* of Peace, is the preſent *Conſtitution* of the *Intereſt* of our *Government*. The chief Deſign of the *Antient Engliſh* was the Glory of ſpreading their Victories on the Continent: but this was a magnanimous Miſtake: for by their very *Conqueſts*, if they had maintain'd them, this *Iſland* had been ruin'd, and had only become a *Province* to a greater *Empire*. But now it is rightly underſtood, that the *Engliſh* Greatneſs will never be ſupported or increaſed in this *Age* by any other Wars but thoſe at *Sea*: and for theſe the Service of the Multitude is fitter than of Gentlemen. This we have beheld practis'd theſe laſt twenty Years, wherein our *Naval Strength* has more than trebled itſelf: for though ſome few *Gentlemen*

*tlemen* have ſtill mingled themſelves in thoſe gallant Actions; yet the Groſs of our *Fleets* have conſiſted of *common Men*, and of *Mariners* who are bred up in the rude Toils of ſuch a Life.

As this *Obſervation* may raiſe us to the greater admiration of their *Valour*, that ſuch *Magnanimity* ſhould be found amongſt the meaneſt of the People; ſo it ſhould alſo ſuggeſt to our *Gentlemen*, who by this means are at liberty from the Employments of greateſt Danger, that they ought to undertake theſe, which will give them as great, though a ſecurer *Honour*. Nor will it be a Diſgrace to them, that the fighting for their *Country* is caſt on Men of lower Ranks, if in the mean time they ſhall ſtrive to enlighten and adorn, while the other defend it: for the ſame is ordain'd by *Nature* itſelf in the Order and Offices of her *Works*; the *Heavenly Bodies* appear to move quietly above, to give Light, and to cheriſh the World with a gentle Influence; while the *Inſtruments* of *War* and *Offence* are taken out of the *Bowels* of the *Earth*.

For the Improvement of theſe *Arts* of *peaceable Fame*, they have indeed another Privilege, which can ſcarce be equall'd by any Kingdom in *Europe*; and that is, the Convenience and Benefit of being ſcatter'd in the *Country*. And in truth, the uſual Courſe of Life of the *Engliſh Gentlemen* is ſo well plac'd between the troubleſome Noiſe of pompous Magnificence, and the Baſeneſs of avaricious Sordidneſs; that the true Happineſs of living according to the Rules and Pleaſures of uncorrupt *Nature*, is more in their power than any others. To them, in this way of Life, there can nothing offer itſelf which may not be turn'd to a *Philoſophical Uſe*. Their *Country Seats* being remov'd from the Tumults of *Cities*, give them the beſt Opportunity,

tunity, and Freedom of *Obſervations*. Their *Hoſpitality*, and familiar Way of converſing with their Neighbourhood will always ſupply them with Intelligence. The Leiſure which their Retirements afford them, is ſo great, that either they muſt ſpend their Thoughts about ſuch Attempts, or in more chargeable and leſs innocent *Divertiſements*. If they will conſider the *Heavens* and the Motions of the *Stars*, they have there a quieter *Hemiſphere*, and a clearer *Air* for that Purpoſe. If they will obſerve the Generations, Breedings, Diſeaſes, and Cures of *living Creatures*; their Stables, their Stalls, their Kennels, their Parks, their Ponds, will give them eternal Matter of Inquiry. If they would ſatisfy their Minds with the advancing of *Fruits*, the beautifying, the ripening, the bettering of *Plants*; their Paſtures, their Orchards, their Groves, their Gardens, their Nurſeries, will furniſh them with perpetual *Contemplations*. They may not only make their *Buſineſs*, but their very *Sports* moſt ſerviceable to *Experimental Knowledge*. For that if it be rightly educated, will ſtand in need of ſuch Recreations as much as the *Gentlemen* themſelves, from their hunting, hawking, fiſhing, and fowling, that is able to receive as much ſolid Profit as they Delight.

On both theſe Accounts the *Engliſh Gentry* has the Advantage of thoſe of *France*, *Spain*, *Italy*, or *Germany*; who are generally either ſhut up in *Towns*, and dream away their Lives in the Diverſions of *Cities*; or elſe are engag'd to follow their *Princes* Wills to foreign Wars.

Nor do they only excel other *Nations* in ſuch Opportunities, but our own *Nobility* of all former Times. Firſt, they are now far more numerous, and ſo more may be ſpar'd from the civil Buſineſs of their Country.

try. Besides this, they are now bred up and live in a quite different Fashion. The Course of their *Ancestors Lives* was grave and reserv'd: they convers'd with few, but their own Servants; and seldom travell'd farther than their own Lands: This way serv'd well enough to keep up their *State* and their *Port*; but not to help their Understandings. For the Formalities of *Life* do often counterfeit *Wisdom*, but never beget it. Whereas now they are engag'd in freer Roads of *Education*; now the vast Distance between them and other Orders of Men is no more observ'd; now their *Conversation* is large and general; now the *World* is become more *active* and *industrious*; now more of them have seen the Use and Manners of Men, and more apply themselves to *Trafic* and Business than ever.

This Alteration has been caus'd in our Memory, either by so many *Families* being advanc'd to the highest Degrees of *Nobility* for their excelling in the *Arts* of the *Gown*; or by their frequent Intermarriages with *Citizens*; or by the Travels of the *King*, and the *Royal Family*; or else by the Civil War itself, which is always wont to be the cruelest *Tyrant*, or the best *Reformer*; either utterly to lay wast, or to civilize, and beautify, and ripen the *Arts* of all Countries. And still we have reason to expect, that this Change will proceed farther for the better, if our *Gentlemen* shall more condescend to engage in Commerce, and to regard the *Philosophy of Nature*.

The first of these since the *King*'s return, has been carry'd on with great Vigour by the *Foundation* of the *Royal Company*; to which as to the Twin-Sister of the *Royal Society*, we have reason as we go along to wish all *Prosperity*. In both these *Institutions* begun toge-

together, our *King* has imitated the two moſt famous *Works* of the wiſeſt of ancient *Kings*; who at the ſame time ſent to *Ophir* for *Gold*, and compos'd a *Natural Hiſtory* from the Cedar to the Shrub.

Nor ought our *Gentry* to be averſe from the promoting of *Trade*, out of any little Jealouſy, that thereby they ſhall debaſe themſelves, and corrupt their Blood: For they are to know, that *Trafic* and *Commerce* have given Mankind a higher Degree than any Title of *Nobility*, even that of *Civility* and *Humanity* itſelf. And at this time eſpecially above all others, they have no reaſon to deſpiſe *Trade* as below them, when it has ſo great an influence on the very *Government* of the World. In former Ages indeed this was not ſo remarkable. The Seats of *Empire* and *Trade* were ſeldom or never the ſame. *Tyre*, and *Sydon*, and *Cades* and *Marſeilles* had more *Trafic*, but leſs Command than *Rome*, or *Athens*, or *Sparta*, or *Macedon*. But now it is quite otherwiſe. It is now moſt certain that in thoſe Coaſts, whither the greateſt *Trade* ſhall conſtantly flow, the greateſt *Riches* and *Power* will be eſtabliſh'd. The Cauſe of this Difference between the ancient Times and our own, is hard to be diſcover'd: perhaps it is this, that formerly the greateſt Part of the *World* liv'd rudely on their own *Natural Productions*: but now ſo many *Nations* being civiliz'd, and living ſplendidly, there is a far greater Conſumption of all *foreign Commodities*; and ſo the Gain of *Trade* is become great enough to over-balance all other Strength: Whether this be the *Reaſon* or no, it matters not; but the Obſervation is true. And this we ſee is ſufficiently known to all our Neighbours, who are earneſtly bent upon the advancing of *Commerce*, as the beſt means not only to enrich particular Merchants, but to enlarge the *Empire*.

The

The next Thing to be recommended to the *Gentlemen* of *England* has a near Kindred with the other; and that is the *Philosophy* of *Nature* and *Arts*. For the want of such an easy Course of Studies, so many of them have miscarried in their first Years, and have ever after abhorr'd all manner of *sober Works*. What else do signify the universal Complaints of those who direct the *Education* of great Men's Children? Why do they find them so hard to be fix'd to any manner of *Knowledge?* Their Teachers indeed are wont to impute it to the delicacy of their Breeding, and to their *Mother's fondness:* But the chief Cause of the Mischief lies deeper: They fill their Heads with difficult and *unintelligible Notions*, which neither afford them Pleasure in Learning, nor Profit in remembring them; they chiefly instruct them in such *Arts*, which are made for the beaten Tracts of Professions, and not for *Gentlemen*. Whereas their Minds should be charm'd by the allurements of *sweeter* and more *plausible Studies*; and for this purpose *Experiments* are the fittest: Their *Objects* they may feel and behold, their *Productions* are most popular; their *Method* is intelligible, and equal to their Capacities; so that in them they may soon become their own *Teachers*.

Nor are they to contemn them for their *Plainness*, and the homely *Matters* about which they are often employ'd. If they shall think scorn to foul their Fingers about them on this Account, let them cast their Eyes back on the *Original Nobility* of all Countries. And if that be true, that every Thing is preserv'd and restor'd by the same Means which did beget it at first; they may then be taught, that their present *Honour* cannot be maintain'd by intemperate *Pleasures*, or the gawdy Shews of Pomp, but by true *Labours* and

*industrious Virtue*: Let them reflect upon those great Men who first made the Name of *Nobility* venerable; and they shall find that amidst the *Government* of *Nations*, the Dispatch of *Armies*, and Noise of *Victories*, some of them disdain'd not to *work* with a Spade, to dig the *Earth*, and to cultivate with triumphing Hands the *Vine* and the *Olive*. These indeed were times, of which it were well if we had more Footsteps than in ancient *Authors*: Then the Minds of Men were innocent and strong, and bountiful as the *Earth* in which they labour'd. Then the Vices of human *Nature* were not their Pride, but their Scorn. Then *Virtue* was itself neither adulterated by the false Idols of *Goodness*; nor puff'd up by the empty Forms of *Greatness*: As since it has been in some Countries of *Europe*, which are arriv'd at that *corruption* of *Manners*, that perhaps some severe *Moralists* will think it had been more needful for me to persuade the Men of this Age to continue Men, than to turn *Philosophers*.

But in this History I will forbear all farther *Complaints*, which were acceptable to the humour of this time, even in our *divine* and *moral Works*, in which they are necessary. I therefore return to that which I undertook, to the agreeableness of this design to all *Conditions* and *Degrees* of our *Nobility*. If they require such *Studies* as are proportionable to the greatness of their *Titles*; they have here those Things to consider, from whence even they themselves fetch the Distinctions of their *Gentility*. The Minerals, the Plants, the Stones, the Planets, the Animals, they bear in their *Arms*, are the chief *Instruments* of *Heraldry*, by which those *Houses* are exalted above those of the Vulgar: And it is a shame for them to boast

of

of the bearing of those Creatures they do not understand. If they value the *Antiquity* of *Families*, and long Race of *Pedigrees*; what can be more worthy their Consideration, than all the diverse Lineages of *Nature?* These have more proof of their ancient Descent than any of them can shew: For they have all continued down in a right Line, from *Cause* to *Effect*, from the *Creation* to this Day. If they shall confine themselves to the *Country*, they have this for their cheap Diversion. If they return to the *City*, this will afford them in every Shop occasions to inform their *Judgments*, and not to devour their *Estates*. If they go forth to *publick Service*, to the leading of *Armies* or *Navies*, they have this for their perpetual Counsellor, and very often for their Preserver. There are so many *natural* and *mechanical Things* to be accurately observ'd by the greatest Captains, as the Advantages of different Arms and Ammunitions, the Passages of Rivers, the Streights of Mountains, the Course of Tides, the Signs of Weather, the Air, the Sun, the Wind, and the like; that though I will not determine the *Knowledge of Nature* to be absolutely necessary to the great Office of a *General*; yet I may venture to affirm, that it will often prove a wonderful Assistance and Ornament to the course of *Glory* which he pursues.

All *Histories* are full of Examples of the great Accidents which have happen'd by the ignorance of chief Commanders in *natural Motions* and *Effects*; of these I will only instance in three: The first is of *Cæsar* himself, who had conquer'd more *Countries* than most Travellers have seen, and gain'd more *Battles* than others have read of; yet he had like to have put a Period to all his *Victories*, by the want of an

exact Skill in one of the commoneſt *Works of Nature*. This he himſelf relates in his ſecond Paſſage into *Britain*; when his Army was ſo diſmay'd at the ebbing of the *Sea* from their Fleet, believing it to be a Stratagem of their *Enemies*, that ſcarce the Courage and Conduct of *Cæſar*, could hinder them from being terrify'd to their own Overthrow, which had been a fatal Misfortune to the *Britains*, as well as *Romans*; becauſe from his victorious Arms, we firſt receiv'd the dawn of *Civil Arts*. The next inſtance of this kind, is the Miſchance which befel the *Chriſtian Army* in *Egypt*, in the time of the *Holy Wars*: Their Strength was great and irreſiſtible, if they had only underſtood, that which every *Egyptian* could have taught them, the Courſe, and the Time of the overflowing of the *Nile*. For the want of that ſlender Knowledge, the braveſt Men of all *Chriſtendom* were led up to the Neck in the River, and were forc'd to yield to their *Enemies* Conditions without ſtriking a Stroke. This was occaſion'd by the Stupidity of the *Cardinal* who commanded them; if he had been leſs skilful in the *Schoolmen*, and more in *Nature*, that dreadful Diſaſter had never happen'd. My third *Example* of this kind is to be found in the *Roman Hiſtory*: The *Roman Army* was juſt ready to join Battle with one of their Enemies; the Sign was given for their Onſet; their Force was equal; a terrible Combat had like to have enſu'd; when on a ſudden the *Sun* was *Eclips'd*; of this the *Romans* were warn'd the Day before. But this ſurpriz'd the other with ſo great Affright, that they were immediately *vanquiſh'd*. So that not the braveſt *Men*, nor the greateſt *Army*, nor the beſt Proviſions of *War* got the *Victory*; but that Party which had the beſt *natural Philoſopher* on its ſide.

To

§. XXXV. *Experiments will be beneficial to our Wits and Writers.*

To this Addreſs which I have made to our *Nobility* and *Gentry*, I will add, as an Appendix, another Benefit of *Experiments*, which perhaps it will ſcarce become me to name amidſt ſo many Matters of greater Weight; and that is, that their Diſcoveries will be very ſerviceable to the *Wits* and *Writers* of this, and all future *Ages*. But this I am provok'd to mention by the Conſideration of the preſent *Genius* of the *Engliſh Nation*; wherein the Study of *Wit*, and Humour of *Writing* prevails ſo much, that there are very few Conditions, or Degrees, or Ages of Men who are free from its Infection. I will therefore declare to all thoſe whom this Spirit has poſſeſs'd, that there is in the *Works of Nature* an inexhauſtible Treaſure of *Fancy* and *Invention*, which will be reveal'd proportionably to the increaſe of their *Knowledge*.

To this purpoſe I muſt premiſe, that it is requir'd in the beſt, and moſt delightful *Wit*; that it be founded on ſuch Images which are generally known, and are able to bring a ſtrong and a ſenſible Impreſſion on the *Mind*. The ſeveral Subjects from which it has been rais'd in all times, are the *Fables* and *Religions* of the *Antients*, the *civil Hiſtories* of all *Countries*, the *Cuſtoms* of *Nations*, the *Bible*, the *Sciences* and *Manners* of *Men*, the ſeveral *Arts* of their Hands, and the Works of *Nature*. In all theſe, where there may be a reſemblance of one thing to another, as there may be in all, there is a ſufficient Foundation for *Wit*. This in all its kinds has its Increaſes, Heights, and Decays, as well as all other human Things: Let us then examine what Parts of it are already exhauſted, and what remain new and untouch'd, and are ſtill likely to be farther advanced.

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The *Wit* of the *Fables* and *Religions* of the *antient World* is well-nigh consumed; they have already serv'd the *Poets* long enough, and it is now high time to dismiss them, especially seeing they have this peculiar *Imperfection*, that they were only *Fictions* at first: Whereas *Truth* is never so well expres's'd or amplify'd, as by those Ornaments which are *true* and *real* in themselves.

The *Wit* which is rais'd from *Civil Histories*, and the Customs of *Countries*, is solid and lasting: The *Similitudes* it affords are substantial, and equal to the Minds of Men, being drawn from themselves and their own Actions. Of this the wittiest Nations have always made the greatest use; their Writings being adorn'd with a *Wit* that was free of their own *Cities*, consisting of *Examples*, and *Apothegms*, and *Proverbs*, deriv'd from their *Ancestors*. This I alledge, because this kind is scarce yet begun in the *English Language*; though our own *Civil History* abounds as much as any other, with great *Examples* and memorable Events, which may serve for the Ornament of Comparison.

The Manners, and Tempers, and Extravagances of Men are a standing and eternal Foundation of *Wit*: This if it be gather'd from particular *Observations*, is call'd *Humour*; and the more particular they are, they are still the pleasanter. In this kind I may well affirm that our *Nation* excels all others, as our *Dramatic Poetry* may witness.

The *Wit* that may be borrow'd from the *Bible* is magnificent, and, as all the other Treasures of *Knowledge* it contains, inexhaustible. This may be us'd and allow'd without any danger of Prophaneness. The *Antient Heathens* did the same; they made their *Divine Ceremonies*

*Ceremonies* the chief Subjects of their *Fancies*; by that means their *Religions* had a more awful impression, became more popular, and lasted longer in force than else they would have done; and why may not *Christianity* admit the same thing, if it be practis'd with *Sobriety* and *Reverence*? What Irreligion can there be in applying some *Scripture-Expressions* to *Natural Things*? Why are not the one rather exalted and purify'd, than the other defil'd by such Applications? The very *Enthusiasts* themselves, who are wont to start at such *Wit* as *Atheistical*, and more guilty of its Excesses than any other sort of Men: For whatever they alledge out of the *Historical*, *Prophetical*, or *Evangelical Writings*, and apply it to themselves, their Enemies, or their Country, though they call it the Mind of *God*, yet it is nothing else but *Scripture-Comparison* and *Similitude*.

The *Sciences* of Mens Brains are none of the best materials for this kind of *Wit*. Very few have happily succeeded in *Logical*, *Metaphysical*, *Grammatical*, nay even scarce in *Mathematical Comparisons*; and the reason is, because they are most of them conversant about Things remov'd from the Senses, and so cannot surprize the *Fancy* with very obvious, or quick, or sensible Delights.

The *Wit* that is founded on the *Arts* of Mens Hands, is masculine and durable: It consists of *Images* that are generally observ'd, and such visible Things which are familiar to Mens Hands. This therefore I will reckon as the first sort, which is still improvable by the Advancement of *Experiments*.

And to this I will add the *Works* of *Nature*, which are one of the best and most fruitful Soils for the growth of *Wit*. It is apparent, that the Defect of

the *Antients* in *natural Knowledge*, did also strengthen their *Fancies:* Those few Things which they knew, they used so much, and applied so often, that they even almost wore them away by their using. The Sweetness of Flowers, and Fruits, and Herbs, they had quite devour'd; they had tir'd out the *Sun*, and *Moon*, and *Stars* with their Similitudes, more than they fancy them to be wearied by their daily Journey round the *Heavens*.

It is now therefore seasonable for *natural Knowledge* to come forth, and to give us the *Understanding* of new *Virtues* and *Qualities* of Things, which may relieve their Fellow-Creatures, that have long born the Burden alone, and have long been vex'd by the Imaginations of *Poets*. This charitable Assistance *Experiments* will soon bestow. The Comparisons which these may afford, will be intellible to all, because they proceed from Things that enter into all Mens Senses. These will make the most vigorous impressions on Mens *Fancies*, because they do even touch their *Eyes*, and are nearest to their *Nature*. Of these the Variety will be infinite, for the Particulars are so from whence they may be deduced: These may be always new and unsullied, seeing there is such a vast Number of *Natural* and *Mechanical Things*, not yet fully known or improved, and by Consequence not yet sufficiently applied.

The use of *Experiments* to this Purpose is evident, by the wonderful Advantage that my Lord *Bacon* receiv'd from them. This excellent Writer was abundantly recompenc'd for his noble Labours in that *Philosophy*, by a vast Treasure of admirable *Imaginations* which it afforded him, wherewith to express and adorn his Thoughts about other Matters. But I will

will not confine this *Observation* to one single *Author*, though he was one of the first and most artificial Managers of this way of *Wit*. I will venture to declare in general of the *English Tongue*, that as it contains a greater Stock of *natural* and *mechanical Discoveries*, so it is also more enrich'd with beautiful *Conceptions*, and inimitable *Similitudes*, gather'd from the *Arts* of Men's Hands and the *Works of Nature*, than ever any other *Language* could produce.

And now I hope what I have here said will prevail something with the *Wits* and *Railleurs* of this *Age*, to reconcile their Opinions and Discourses to these *Studies*: for now they may behold that their Interest is united with that of the *Royal Society*; and that if they shall decry the promoting of *Experiments*, they will deprive themselves of the most fertil Subject of *Fancy*: and indeed it has been with respect to these terrible Men, that I have made this long Digression. I acknowledge that we ought to have a great Dread of their Power: I confess I believe that *new Philosophy* need not (as *Cæsar*) fear the pale or the melancholly, as much as the humorous and the merry: For they perhaps by making it ridiculous because it is *new*, and because they themselves are unwilling to take pains about it, may do it more Injury than all the Arguments of our severe and frowning and dogmatical *Adversaries*.

But to gain their good Will, I must acquaint them, that the Family of the *Railleurs* is deriv'd from the same Original with the *Philosophers*. The Founder of *Philosophy* is confess'd by all to be *Socrates*; and he also was the famous Author of all *Irony*. They ought therefore to be tender in this matter, wherein the Honour of their *common Parent* is concern'd: it be-

comes them to remember that it is the Fault, and not the Excellence of *Wit* to defile its own Neſt, and not to ſpare its own Friends and Relations, for the Sake of a Jeſt.

The truth is, the Extremes of *Raillery* are more offenſive than thoſe of *Stupidity*: It is a Work of ſuch a tender and ſubtil Spirit, that it cannot be decently perform'd by all Pretenders to it; nor does it always agree well with the Temper of our *Nation*; which as it has a greater Courage than to ſuffer *Deriſion*, ſo it has a firmer Virtue than to be wholly taken up about deriding of others. Such Men are therefore to know, that all things are capable of abuſe from the ſame *Topicks* by which they may be commended; they are to conſider, that Laughter is the eaſieſt and the ſlendereſt Fruit of *Wit*; they are to underſtand, that it proceeds from the Obſervation of the *Deformity* of things; but that there is a nobler and more maſculine Pleaſure, which is rais'd from beholding their *Order* and *Beauty*: From thence they may conclude, how great the Difference is between them and the real *Philoſophers*; for while *Nature* has only form'd them to be pleas'd with its Irregularities and Monſters, it has given the other the Delight of knowing and ſtudying its moſt *beautiful Works*.

In plain Terms, a univerſal Abuſe of every thing, though it may tickle the Fancy never ſo much, is *inhuman Madneſs*; as one of the *Antients* well expreſſes it, who calls ſuch Mirth *humanis Bacchari rebus*. If all things were made the Subjects of ſuch Humour, all worthy deſigns would ſoon be laugh'd out of the World; and for our preſent Sport, our *Poſterity* would become barbarous. All good Enterpriſes ought to find Aſſiſtance when they are begun, Applauſe when they

they ſucceed, and even Pity and Praiſe if they fail. The true *Raillery* ſhould be a Defence for *good* and *vertuous Works*, and ſhould only intend the Deriſion of extravagant, and the Diſgrace of vile and diſhonourable Things. This kind of *Wit* ought to have the Nature of *Salt*, to which it is uſually compar'd; which preſerves and keeps ſweet the good and ſound Parts of all Bodies, and only frets, dries up, and deſtroys thoſe Humours which putrify and corrupt.

Sect. XXXVIII. *Experiments advantagious to the Intereſt of our Nation.*

This pleaſant but unprofitable ſort of Men being thus diſmiſs'd with this fair *Admonition*; it now follows in the laſt Place, that I examine the univerſal Intereſt of the *Engliſh Nation*, and conſider what Effect the *Works* of the *Royal Society* are like to have upon it, by what means their *Labours* may ſerve to encreaſe our Advantages, and correct our Imperfections. In the Entrance of this Subject there are ſo many things preſented to my Thoughts, which are worthy to be declar'd to my *Countrymen*, that I rather think it ought to be largely manag'd by itſelf, than to be huddled up in the end of this *Treatiſe*: and certainly there is ſcarce any matter that more deſerves to be handled by the beſt of our *Engliſh Wits*, than the *Intereſt* of their *Country*. I do therefore take the Freedom to recommend it to their Hands; and to beſeech them to raiſe their Thoughts from ſlighter Buſineſſes, from unmanly Flatteries, or Vanities of *Love*, or uſeleſs *Burleſque*, to this grave and this noble *Argument*; and to remember that if *Themiſtocles* was in the right, when he preferr'd the making of a ſmall City great before the playing on a Fiddle, then certainly it is the braveſt Employment for a worthy Mind, to endeavour to make a great *Kingdom* greater.

There are very many Things in the *natural Genius* of the *Engliſh*, which qualify them above any other for a *governing Nation*. The Situation of our *Country* is moſt advantagious for *Command*: Its native Productions are moſt ſerviceable for *Strength* and *Empire*: The Diſpoſition of the People is bold in Dangers, ſevere in Diſcipline, valiant in Arms, virtuous in Life, relenting to the Afflicted, and merciful in Conqueſt. The unfortunate Diviſions by which our *Force* has been of late diſtracted, are but of one or two *Ages* growth; the Vices to which we are ſubject are not natural to our *Soil*, but imported hither from foreign *Countries*: The *Engliſh* Generoſity, Fidelity, Magnanimity, Modeſty, Integrity, they owe to themſelves; their Luxury, their Debauchery, their Diviſions, their ſpiritual Schiſms, they have receiv'd from abroad.

And now what can be a greater Work than the Management of all theſe matters? Here the *Writer* might have occaſion of doing right to the Honour of his *Country*, and yet reproving its Faults with a juſt Cenſure: he might explain the Weakneſſes and Advantages of our *Kingdom*: he might remove the one, and confirm the other: he might compare the Actions of our *Anceſtors* with the Manners of this *Time*, and ſhew by what degrees this Diſſolution of *Goodneſs* crept in: he might with a generous and tender Hand, apply himſelf to the Cure of *Religious Diſtempers*: he might with irreſiſtable *Arguments* attempt to amend what is amiſs, reſtore the *good*, and by the Power of domeſtick Examples reduce us back to the antient Sincerity of *dealing*, and *innocence* of *Life*, and union of *Intereſts*.

The Deſire of ſeeing this Work perform'd ſits ſo much on my Mind, that I cannot but once more repreſent it

to

to the Consideration of the many Eloquent and Judicious *Authors*, with whom our *Nation* is now more abundantly furnish'd than ever. But if neither the Necessity nor Usefulness of the Subject, nor the Benefit of their native Land will prevail with them to set upon it; it is my purpose to excite them by another way, which will indeed be hazardous to my own *Reputation*, yet perhaps may take effect. I will try the same Stratagem which I have often seen unskilful Singers use, to make those who have excellent Voices shew their *Art*: for as they by ill *Singing* some excellent Tune are wont to provoke the others to *sing*, when no Persuasions could move them; so do I intend at my first Leisure, by ill handling of this *noble Subject*, to stir up Men of greater Abilities to employ their Skill and their Judgment about it.

Having thus taken this Task on myself, it will not be needful here to insist long upon it before hand: I will only in a few Words declare, that it is the true Concernment of *England* to secure itself from the *Dominion* of *Strangers*, both *Ecclesiastical* and *Temporal*; to advance its Industry in peaceful *Arts*; to increase its *People*; to improve its own *Manufactures*; to introduce the foreign, of which our Soil is capable; to make use of the two *Kingdoms* that are join'd with it under the same *Monarch*, for those Productions which grow not at Home; to obtain a Union of Mind, both in *Civil* and *Spiritual Matters*; and to preserve the antient Form of *Government*.

Of all these I will only touch upon those Parts of our *Interest* which have reference to the Design of the *Royal Society*.

The first thing that ought to be improv'd in the *English Nation*, is their *Industry*. This, it is true, has

of

of late Years been marvellously advanc'd; as may be shewn by the enlarging of *Trafic*, the spreading of many *Fruits*, the Plantations of *Trees*, and the great Improvement of *Manual Arts*. But it is evident, that it may still admit of farther Warmth and Activity; as we may conclude, by the Want of Employment for younger Brothers, and many other Conditions of Men; and by the number of our Poor, whom *Idleness* and not *Infirmities* do impoverish. The way to compass this, is not alone by *Acts of Parliament*, and good *Laws*; whose Force will soon be evaded by present Craft and Interpretation, or else will be *antiquated* by Time. This perhaps our Country has found above all others: if our *Labourers* had been as diligent as our *Law-givers*, we had prov'd the most laborious Nation under *Heaven*. But the true Method of increasing *Industry*, is by that Course which the *Royal Society* has begun in *Philosophy*, by *Works* and *Endeavours*, and not by the Prescriptions of *Words*, or *Paper Commands*.

There is nothing whose promoting is so easy as *Diligence*, when it is once set on foot. This does not only propagate *Works* but *Workers*; though at first it may begin on *Necessity*, yet it will afterwards proceed upon *Pleasure*: So that the farther it goes, the swifter it advances, because *willing Works* are sooner perform'd than those to which we are compell'd. This I will demonstrate by an *Instance* which I have already alledg'd, and it is of the *Hollanders*: for we may fetch *Examples* of *Virtue* from our own Countrymen, but of *Industry* from them. At first they were as lazy as the worst of ours: their Hands were unus'd to labour; their manner of Life was much like that of the *antient Britains*; their Coasts lay desolate to the Sea, without

out Banks, or Towns, or Ships, or Harbours: and when the *Roman Emperor* gather'd Cockles there, perhaps there was little elſe worth gathering. But when by the number of their People they were forc'd to look abroad, to trade, to fiſh, to *labour* in *Mechanics*; they ſoon found the Sweetneſs as well as the Toil of their *Diligence:* their Succeſſes and Riches ſtill added new Heat to their Minds; and thus they have continued *improving*, till they have not only diſgrac'd but terrify'd their *Neighbours* by their *Induſtry*. Nor will it ſuffice to tell us, that they owe this Activity to the Form of their *Government*. That Suppoſition may preſently be confuted by the Example of *France*, the moſt abſolute *Monarchy* of *Chriſtendom:* There it is apparent by the prodigious Toils of their People, both upon the Earth, and in their Shops, that *Diligence* may thrive in a *Kingdom* as well as a *Commonwealth*.

And if ever the *Engliſh* will attain to the *Maſtery* of *Commerce*, not only in *Diſcourſe*, but *Reality*, they muſt begin it by their *Labours*, as well as by their *Swords:* they muſt do it by awakening their Minds, by rouzing themſelves from this Lethargy, by *Action*, by *Trials*, by *Working:* Unleſs this be done, they will in vain be *Victorious:* at the end of their *Wars* they will cool again, and loſe all the Fruits of their *Valour*. The *Arts* of Peace, and their Improvements, muſt proceed in equal Steps with the Succeſs of their *Arms:* The *Works* of our Citizens, our Plough-men, our Gardeners, our Wood-men, our Fiſhers, our Diggers in Mines, muſt be equally advanc'd with the *Triumphs* of our *Fleets*; or elſe their Blood will be ſhed in vain: they will ſoon return to the ſame Poverty, and want of *Trade*, which they ſtrove to avoid. For as *Tully* profeſſes, *neminem video eloquentem factum eſſe victoriâ:*

*riâ:* So will I affirm, *that we ſhall never be made Induſtrious by Victory alone.*

The ſecond Thing to be corrected in the *Engliſh Humour*, is an Inclination to every *Novelty* and Vanity of foreign *Countries*, and a Contempt of the good things of our own. This Fondneſs is the uſual Fault of young *Travellers*, but it has alſo ill Effects on Men of full *Age:* For this they are wont to alledge the Excuſe of good *Breeding*. But if we could not ſtudy or underſtand our own Country, without the Imputation of ill Manners, good *Breeding* were the moſt pernicious thing in the World. For there was never yet any *Nation* great, which only admir'd the Cuſtoms of other People, and wholly made them the Pattern of their Imitation. This wandring and affected Humour *Experiments* will leſſen above all other *Studies:* they will employ our Thoughts about our native Conveniences: they will make us intend our Minds on what is contained within our own Seas: and by conſidering and handling them more, will alſo make them more worthy of our Conſideration.

The third *Imperfection* is on the other Extreme, and that is a *narrowneſs of Mind*, and a *puſillanimous confining* our Thoughts to ourſelves, without regarding any thing that is foreign, or believing that any of their *Arts* or *Cuſtoms* may be preferr'd before our own. This indeed is a Perverſeneſs, of which the *Engliſh* are not wholly to be acquitted: it being proper to *Iſlands*, and to ſuch *Countries* that are divided from the reſt of the *World*. This will be cur'd by the effectual *Demonſtrations* that the *Society* will give of the Benefit of a univerſal *Correſpondence* and *Communication*. And this, according to their Method, will be done without falling into the other Vice of affecting

ing foreign *Habits*, and *Manners*, and *Geſtures*. In theſe the *Engliſh* need not be beholden to others; but in their Fruits, in their Manufactures, in their Engines, in their Works in Gold, and Silver, and Braſs, and Iron, we may follow their Practice, and emulate their Curioſities without Affectation.

There is one Inſtance which will ſhew how our Reſpect to outlandiſh Things is to be regulated. To depend on the *French* for every little Faſhion of Cloaths, and to equal their *Nobility* in their way of Life, is neither for our Honour nor Profit. For the difference between their *Gentry* and ours, and their *Commonalty* and ours, is ſo great, that the ſame Manners will not be decent in us, which become them well enough. But to learn from them their *Skill* in *Horſemanſhip* and *Arms*, their *Building*, their *Cultivation of Fruits*, the *Parſimony* and *Induſtry* of their *Tradeſmen*, is commendable; for in theſe Things we are defective, and they excel. It is therefore the Admiration of foreign *Extravagancies*, and not the Imitation of their *Excellencies* that is to be condemn'd. If we will rather obſtinately be content with our own Store, than borrow what is good from Abroad; we flatter our ſelves with the ſame fooliſh Imaginations, that all *Countries* had, while they were barbarous. To them their *Acorns* and their *Cottages* were at firſt the utmoſt Ends of their Ambition. They knew no more, nor aſpir'd to any farther Addition; but as ſoon as a new Light ſprung forth amongſt them, they deſpis'd themſelves and their former Condition; and then they firſt began to underſtand their *Wants*, when they perceiv'd how they might be ſupply'd. As long as we find that all parts of our *Country* are not Ingenious, Inventive, and Induſtrious alike, we cannot preſume that we

have already got beyond all possibility of *Amendment* by others Patterns. As long as we behold any *City* or *Province*, or *Family*, or *Street* of our Neighbours, exceed the worst of ours, I will not say the best in Easiness of *Life*, or Pleasantness or Smoothness of *Manners*, we have no reason to arrogate too much to our selves; but we rather should conceive it to be a less disgrace to tread in their *Footsteps*, than to want their Perfections. As long as there remains any room for our most civil *People* to grow more *Civil*, the Introduction of foreign *Inventions* is not only *pardonable*, but *necessary*; for such is the Nature of *Civility*, that as it increases, it still requires more *Arts*, though it contents itself with less Forms of living.

The fourth Mischief by which the Greatness of the *English* is suppress'd, is a want of Union of *Interests* and *Affections*. This is originally caus'd by a natural Reservedness, to which our Temper is inclin'd; but it has been heighten'd by our *Civil Differences*, and *Religious Distractions*. For the sweetning of such Dissentions, it is not best at first to meet and converse about Affairs of State, or spiritual Controversies. For those did first occasion our *Animosities*, and the more they are rubb'd, the rawer they will prove. But the most effectual Remedy to be us'd, is, first to assemble about some *calm* and *indifferent* Things, especially *Experiments*. In them there can be no cause of mutual *Exasperations*: In them they may agree, or dissent without Faction or Fierceness; and so from enduring each others *Company*, they may rise to a bearing of each others *Opinions*; from thence to an exchange of good *Offices*; from thence to real *Friendship*: Till at last by such a gentle and easy *Method*, our several *Interests*,

*tereſts* and *Sects* may come to ſuffer one another, with the ſame Peaceableneſs as Men of different *Trades* live one by another in the ſame *Street*.

Nor is it the leaſt Commendation the *Royal Society* deſerves, that deſigning a Union of Mens *Hands* and *Reaſons*, it has proceeded ſo far in uniting the *Affections*; for there we behold an unuſual Sight to the *Engliſh Nation*, that Men of diſagreeing Parties, and ways of Life, have forgotten to hate, and have met in the unanimous Advancement of the ſame *Works*. There the *Soldier*, the *Tradeſman*, the *Merchant*, the *Scholar*, the *Gentleman*, the *Courtier*, the *Divine*, the *Presbyterian*, the *Papiſt*, the *Independant*, and thoſe of *Orthodox Judgment*, have laid aſide their Names of Diſtinction, and calmly conſpir'd in a mutual Agreement of *Labours* and *Deſires*: A Bleſſing which ſeems even to have exceeded that Evangelical Promiſe, *That the Lion and the Lamb ſhall lie down together*; for here they do not only endure each others Preſence without Violence or Fear, but they *work* and *think* in Company, and confer their help to each others *Inventions*.

§. XXXIX. *Experimental Knowledge will not hinder Obedience.*

THE laſt part of the *general Intereſt* of our *Nation*, in which I will ſurvey the influence of *Experiments*, is *Obedience to the Civil Government*; and we ought to be very watchful that they prove not offenſive to the *Supreme Power*; for ſeeing the *King* has honour'd them with his *Royal Patronage*, it is but juſt that the *Prerogatives* of his *Crown* ſhould be no loſers by their Increaſe. It is indeed a common Accuſation, which is wont to be made againſt all manner of *Knowledge*, by thoſe who have it not, that it renders Men mutinous, arrogant, and incapable of *Superiors*; but if this be

admitted, we ſhall aſperſe *human Nature* and *Government* with the greateſt Calumny. This were to affirm, that Men cannot exerciſe their *Reaſon* without being *Factious* and *Unruly*; and that *Civil Government* will be inſupportable to all but ignorant Men and Fools; which is ſo far from being true, that it were eaſy to prove that thoſe *Nations* which are void of all *Arts* and *Knowledge*, cannot be properly ſaid to pay a right *Obedience* to their *Sovereigns*; but that the Subjection under which they live, rather deſerves to be ſtyl'd the Stupidity and Slavery of Beaſts, than a juſt and a manly Submiſſion.

But to limit this Queſtion to the particular kind of *Knowledge*, which is now under debate, it is certain that the Skill of *Nature* ought ſo little to be ſuſpected for making Men perverſe and ungovernable, that it is the beſt Preſervative againſt *Diſobedience*. One of the principal Cauſes of this is a miſguided *Conſcience*, and oppoſing the pretended Dictates of *God* againſt the Commands of the *Sovereign*. This I have already ſhewn, that theſe *Labours* will moderate and reform by aboliſhing or reſtraining the Fury of *Enthuſiaſm*. Another is idle Poverty, which drives Men into Sullenneſs, Melancholy, Diſcontent, and at laſt into reſiſtance of *lawful Authority*. To this *Experiments* will afford a certain Cure; they will take away all pretence of Idleneſs, by a conſtant courſe of pleaſant Endeavours; they will employ Men about profitable *Works*, as well as *delightful*; by the Pleaſure of their *Diſcoveries* they will wear off the Roughneſs, and ſweeten the humorous Peeviſhneſs of Mind, whereby many are ſowr'd into *Rebellion*.

But the moſt fruitful Parent of *Sedition* is *Pride*, and a lofty conceit of Mens own *Wiſdom*; whereby they

they presently imagine themselves sufficient to direct and censure all the *Actions* of their *Governors*. And here that is true in *Civil Affairs*, which I have already quoted out of my Lord *Bacon* concerning *Divine*: A little *Knowledge* is subject to make Men headstrong, insolent, and untractable; but a great deal has a quite contrary Effect, inclining them to be submissive to their *Betters*, and obedient to the *Sovereign Power*.

The *Science* that is acquir'd by *Disputation*, teaches Men to cavil well, and to find fault with accurate Subtilty; it gives them a fearless Confidence of their own Judgments; it leads them from contending in Sport, to Oppositions in earnest; it makes them believe that every thing is to be handled for and against, in the *State*, as well as in the *Schools*. But the unfeign'd and laborious *Philosophy* gives no Countenance to the vain Dotages of private *Politicians*; that bends its *Disciples* to regard the Benefit of Mankind, and not the Disquiet; that by the Moderation it prescribes to our Thoughts about *Natural Things*, will also take away all sharpness and violence about *Civil*; the *Work* of that is so vast, that it cannot be perform'd without the Assistance of the *Prince*; it will not therefore undermine his *Authority* whose Aid it implores; that prescribes a better way to bestow our time, than in contending about little Differences, in which both the Conquerors and the Conquer'd have always reason to repent of their Success; that shews us the difficulty of ordering the very Motions of senseless and irrational Things; and therefore how much harder it is to rule the restless Minds of Men; that teaches Men *Humility*, and acquaints them with their own *Errors*; and so removes all overweening Haughtiness of Mind, and swelling Imaginations, that they are better able

to

to manage Kingdoms than those who possess them. This, without question, is the chief Root of all the uneasiness of *Subjects* to their *Princes*. The World would be better govern'd, if so many did not presume that they are fit to sustain the Cares of *Government*. Transgression of the *Law* is *Idolatry*: The *Reason* of Mens contemning all *Jurisdiction* and *Power*, proceeds from their idolizing their own *Wit*; they make their own Prudence omnipotent; they suppose themselves *infallible*; they set up their own *Opinions*, and worship them. But this vain *Idolatry* will inevitably fall before *Experimental Knowledge*; which as it is an *Enemy* to all manner of false *Superstitions*, so especially to that of Mens *adoring themselves*, and *their own Fancies*.

Sect. XL. *The Conclusion, being a general Recommendation of this Design.*

I HAVE now at last brought my Reader by a tedious Compass, to the end of our Journey: And here I desire him to look back, and to make a Reflection on the Matters of which I have treated. In the first part of my Discourse I have alledg'd the Causes by which these *Studies* were suppress'd in all former *Ages*; which have been Interests of *Sects*, the Violence of *Disputations*, the plausible Arts of *Speech*, the *Religious Controversies*, the *Dogmatical Opinions*, the *Poverty* of the *Undertakers*, and the want of a continual Race of *Experimenters*. In the second I have shew'd by what Steps the *Royal Society* arose, what it has propos'd to attempt, what Course it has taken to make its *Observations* universal and perpetual; what Assistance has been afforded it to that Purpose, and about what Particulars it has been conversant. In the third I have try'd to free it from the false Scandals of *Ignorance*, and the Prejudices of several ways of Life, and

to prove that its Effects will more immediately refer to our own Country.

My Reader now beholds an Assembly settled of many eminent Men of all Qualities, who have engag'd to bestow their Labours on a design so publick, and so free from all Suspicion of mean or private Interest. What Foundation they have within themselves, for defraying the Expence of their *Trials* and *Intelligence*, may be guess'd by their *Number*, which at this present amounts very near to *two Hundred*; as appears by this following *Catalogue*, which I have rang'd *Alphabetically*.

The *King's* Majesty, *Founder* and *Patron*.
His Royal Highness the *Duke* of *York*.
His Highness Prince *Rupert*.
His Highness *Ferdinand Albert*, *Duke* of *Brunswick* and *Lunenburgh*.

The *Duke* of *Albemarle*, the *Earl* of *Ailsbury*, the *Earl* of *Argile*, the *Lord Ashley*, the *Lord Annesly*, Mr. *Ashmole*, Sir *Robert Atkins*, Mr. *Austin*, Monsr. *Auzout*, Mr. *Awbrey*.

The *Duke* of *Buckingham*, the Lord *George Berkeley*, the Lord *Brereton*, Mr. *Bagnal*, Mr. *Bains*, Mr. *William Balle*, Mr. *Isaac Barrow*, Dr. *George Bate*, Dr. *Bathurst*, Dr. *Beal*, Monsr. *Beaufort de Frasars*, Sir *John Birkenhead*, Mr. *Blunt*, Mr. *Boyl*, Mr. *Brook*, Dr. *Bruce*, Monsr. *Bullialdus*, Mr. *Burnet*, Sir *Edward Byshe*.

The Lord *Archbishop* of *Canterbury*; the Earl of *Clarendon*, Lord *Chancellor* of *England*; the Earl of *Carlisle*, the Earl of *Craford* and *Lindsay*, the Lord *Cavendish*, the Lord *Clifford*, Mr. *Carkess*, Mr. *Carter* et

Dr.

Dr. *Charleton*, Sir *Winſtone Churchill*, Sir *John Clayton*, Sir *Clifford Clifton*, Mr. *George Cock*, Sir *Richard Corbet*, Dr. *Cotton*, Dr. *Cox*, Mr. *Thomas Cox*, Mr. *Daniel Cox*, Mr. *Creed*, Mr. *Criſpe*, Sir *John Clutter*.

The Marqueſs of *Dorcheſter*, the Earl of *Devonſhire*, the Earl of *Dorſet*, Monſ. *Vital de Damas*, Sir *George Ent*, Mr. *Elliſe*, Mr. *John Evelyn*, Sir *Francis Fane*, Monſ. *le Febvre*, Sir *John Finch*, Mr. *Henry Ford*, Sir *Bernhard Gaſcoigne*, Mr. *Joſeph Glanvile*, Dr. *Gliſſon*, Mr. *William Godolphin*, Mr. *Graunt*.

The Lord *Hatton*, Mr. *Haak*, Mr. *William Hammond*, Mr. *William Harrington*, Sir *Edward Harley*, Sir *Robert Harley*, Mr. *Harley*, Dr. *Henſhaw*, Monſ. *Hevelius*, Mr. *Abraham Hill*, Mr. *Hoar*, Dr. *Holder*, Mr. *Hook*, Mr. *Charles Howard*, Monſ. *Huygens*.

Mr. *Richard Jones*, the Earl of *Kincardin*, Sir *Andrew King*, Mr. *Edmund King*, the Earl of *Lindſey*, the Lord Biſhop of *London*, Mr. *Lake*, Sir *Ellis Leighton*, Mr. *James Long*, Sir *John Lowther*, Mr. *Lowther*, Monſ. *Hugnes de Lyonne*.

The Earl of *Mancheſter*, Monſ. *Nicholas Mercator*, Dr. *More*, Dr. *Jaſper Needham*, Dr. *Needham*, Mr. *Thomas Neile*, Mr. *William Neile*, Mr. *Nelthorp*, Mr. *Newburgh*, Sir *Thomas Nott*, the Earl of *Peterburgh*, Mr. *Packer*, Mr. *Samuel Parker*, Sir *Robert Paſton*, Dr. *John Pearſon*, Dr. *Pell*, Sir *William Perſall*, Sir *Peter Pett*, Mr. *Peter Pett*, Monſ. *Petit*, Sir. *William Portman*, Mr. *Francis Potter*, Mr. *Povey*, Dr. *Power*, Sir *Richard Powle*, Mr. *Pepys*,

The Lord *Roberts* Lord *Privy Seal*, the Lord Biſhop of *Rocheſter*, Mr. *Rolt*, Mr. *Rycaut*, the Earl of *Sandwich*, the Lord Viſcount *Stafford*, the Lord *Stermont*, Mr. *Schroter*, Sir *James Shaen*, Mr. *Skippon*, Sir *Nicholas Slaney*, Mr. *Henry Slingsby*, Mr. *Smethwick*, Mr. *Edward*

*Edward Smith*, Dr. *George Smith*, Monſ. *Sorbiere*, Sir *Robert Southwell*, Mr. *Alexander Stanhope*, Mr. *Thomas Stanley*.

The Earl of *Tweedale*, Sir *Gilbert Talbot*, Sir *John Talbot*, Dr. *Terne*, Mr. *Thomas Thyn*, Dr. *Thruſton*, Sir *Samuel Tuke*, Sir *Theodore de Vaux*, Mr. *Vermuyden*, Monſ. *Iſaac Voſſius*.

The Lord Biſhop of *Wincheſter*, Mr. *Waller*, Dr. *Wallis*, Mr. *Waterhouſe*, Dr. *Whiſtler*, Mr. *Joſeph Williamſon*, Dr. *Willis*, Mr. *Francis Willoughby*, Mr. *Wind*, Mr. *Winthorp*, Mr. *Woodford*, Mr. *Matthew Wren*, Dr. *Thomas Wren*, Sir *Cyril Wyche*, Sir *Peter Wyche*, Mr. *Wylde*, the Lord Archbiſhop of *York*, the Lord *Yeſter*.

The preſent *Council* are theſe that follow:

*William* Lord Viſcount *Brouncker*, Preſident; which Office has been annually renew'd to him by Election, out of the true Judgment which the *Society* has made of his great *Abilities* in all *Natural*, and eſpecially *Mathematical Knowledge*.

Mr. *William Aerskin*, Dr. *Peter Ball*, Dr. *Timothy Clerk*, Mr. *Daniel Colwall*, Dr. *Croon*, the Lord Biſhop of *Exeter*, Dr. *Jonathan Goddard*, Mr. *Henry Howard* of *Norfolk*, Mr. *Henſhaw*, Mr. *Hoskins*, Sir *Robert Moray*, Sir *Anthony Morgan*, Dr. *Merret*, the Earl of *Northampton*, Sir *Paul Neile*, Mr. *Oldenburgh*, Sir *William Petty*, Dr. *Pope*, Dr. *Wilkins*, Dr. *Chriſtopher Wren*.

In this number perhaps there may ſome be found, whoſe *Employments* will not give them leave to promote theſe *Studies* with their own *Hands*. But it being their Part to *contribute* jointly towards the *Charge*, and to paſs *Judgment* on what others ſhall

*try*; they will appear to be well nigh as useful as those that *labour*, to the main End of this *Enterprize*.

Whatever *Revenue* they shall raise by this or any other means, they intend thereby to make an Establishment for their *Curators*. To this Office they have already admitted some of their *Fellows*, whom they will employ according to their *Studies* and *Sufficience*: Some shall be sent to travel abroad to search for *Discoveries*; some shall constantly remain in *London*, and represent their *Observations* to the weekly *Assemblies*.

The Places of their *Residence* they have appointed to be two: one a *College*, which they design to build in *London*, to serve for their *Meetings*, their *Laboratories*, their *Repository*, their *Library*, and the Lodgings for their *Curators*: The other the *College* at *Chelsea*, which the *King* has bestow'd on them; where they have a large Inclosure to serve for all *Experiments* of *Gardening* and *Agriculture*; and by the neighbourhood of the *River* they have excellent Opportunity of making all *Trials* that belong to the Water.

And now as I have spoken of a *Society* that prefers *Works* before *Words*, so it becomes their *History* to endeavour after real *Fruits* and *Effects*. I will therefore conclude, by recommending again this *Undertaking* to the *English Nation*; to the *bravest People*, the most *generous Design*; to the most zealous Lovers of *Liberty*, the surest Way to ransom the Minds of all Mankind from *Slavery*.

The Priviledges that our *King*'s Dominions enjoy for this End, appear to be equall'd by no other *Country*. The Men that we have now living to employ, are excellently furnish'd with all manner of Abilities: Their Method is already settled, and plac'd out of the reach of Calumny or Contradiction.

The

The Work itſelf indeed is vaſt, and almoſt incomprehenſible, when it is conſider'd in Groſs: But they have made it feaſible and eaſy, by diſtributing the Burden. They have ſhewn to the World this great Secret, That *Philoſophy* ought not only to be attended by a ſelect Company of *refin'd Spirits*. As they deſire that its Productions ſhould be *vulgar*, ſo they alſo declare, that they may be promoted by *vulgar Hands*. They exact no extraordinary Preparations of *Learning*; to have ſound *Senſes* and *Truth*, is with them a ſufficient Qualification. Here is enough Buſineſs for *Minds* of all Sizes: And ſo boundleſs is the Variety of theſe *Studies*, that here is alſo enough Delight to recompence the Labours of them all, from the moſt ordinary Capacities, to the higheſt and moſt ſearching *Wits*.

Here firſt they may take a plain View of all particular Things, their Kinds, their Order, their Figure, their Place, their Motion: and even this naked Proſpect cannot but fill their Thoughts with much Satisfaction, ſeeing it was the firſt Pleaſure which the *Scripture* relates *God* himſelf to have taken at the *Creation*; and that not only once, but at the end of every Day's Work, when he ſaw all that he had made, and approv'd it to be good. From this they may proceed to ſurvey the Difference of their Compoſition, their Effects, the Inſtruments of their Beings and Lives, the Subtilty and Structure, the Decay and Supply of their Parts; wherein how large is the ſpace of their Delight, ſeeing the very Shape of a *Mite*, and the Sting of a *Bee* appears ſo prodigious. From hence they may go to apply Things together, to make them work one upon another, to imitate their Productions, to help their Defects, and with the nobleſt Duty to aſſiſt *Na-*

*ture*, our common Mother, in her *Operations*; from hence to all the works of Mens hands, the divers *Artifices* of ſeveral *Ages*, the various Materials, the improvement of *Trades*, the advancement of *Manufactures*; in which laſt alone there is to be found ſo great Content, that many mighty Princes of the former and preſent Times, amidſt the pleaſures of *Government*, which are no doubt the higheſt in the World, have ſtriven to excel in ſome *Manual Arts*.

In this ſpacious Field their *Obſervations* may wander, and in this whatever they ſhall meet with, they may call their own. Here they will not only enjoy the cold contentment of *Learning*, but that which is far greater, of *Diſcovering*. Many things that have been hitherto hidden, will ariſe and expoſe themſelves to their view; many Methods of advancing what we have already, will come in their way; nay, even many of the loſt *Rarities* of *Antiquity* will be hereby reſtor'd. Of theſe a great quantity has been overwhelm'd in the ruins of *Time*; and they will ſooner be retriev'd by our labouring anew in the material Subjects whence they firſt aroſe, than by our plodding everlaſtingly on the antient *Writings*. Their *Inventions* may be ſooneſt regain'd the ſame way by which their *Medals* and *Coins* have been found; of which the greateſt part has been recover'd, not by thoſe who ſought for them on purpoſe in old Rubbiſh, but by digging up Foundations to raiſe new Buildings, and by plowing the Ground to ſow new Seed.

This is the *Work* we propoſe to be encourag'd, which at once regards the diſcovering of new *Secrets*, and the purifying and repairing all the profitable Things of *Antiquity*. The Supply that is needful to finiſh it, will neither impoveriſh Families, nor exhauſt

hauſt a mighty Income. So near is Mankind to its Happineſs, that ſo great an *Attempt* may be plentifully endow'd by a ſmall part of what is ſpent on any one ſingle Luſt, or extravagant Vanity of the Time. So moderate is the *Society* in their deſires of Aſſiſtance, that as much Charity as is beſtow'd in *England* in one Year, for the relief of particular Poverty and Diſeaſes, were enough for ever to ſuſtain a *Deſign*, which endeavours to give Aid againſt all the Infirmities and Wants of *human Nature*.

If now this *Enterprize* ſhall chance to fail for want of *Patronage* and *Revenue*, the World will not only be fruſtrated of their preſent Expectations, but will have juſt ground to deſpair of any future *Labours*, towards the increaſe of the *Practical Philoſophy*. If our *Poſterity* ſhall find, that an *Inſtitution* ſo vigorouſly begun, and ſo ſtrengthen'd by many ſignal Advantages, could not ſupport itſelf; they will have reaſon in all times to conclude, That the long barrenneſs of *Knowledge* was not caus'd by the corrupt Method which was taken, but by the Nature of the *Thing* itſelf. This will be the laſt great Endeavour that will be made in this way, if this ſhall prove ineffectual; and ſo we ſhall not only be guilty of our own *Ignorance*, but of the *Errors* of all thoſe that come after us.

But if (as I rather believe and preſage) our *Nation* ſhall lay hold of this Opportunity, to deſerve the applauſe of Mankind, the force of this *Example* will be irreſiſtibly prevalent in all *Countries* round about us; the State of *Chriſtendom* will ſoon obtain a new Face: while this *Halcyon Knowledge* is breeding, all *Tempeſts* will ceaſe; the Oppoſitions and Contentious Wranglings of *Science*, falſly ſo call'd, will ſoon vaniſh

vaniſh away; the peaceable calmneſs of Mens *Judgments* will have admirable influence on their *Manners*; the ſincerity of their *Underſtandings* will appear in their *Actions*; their *Opinions* will be leſs violent and dogmatical, but more certain; they will only be *Gods* one to another, and not *Wolves*; the value of their *Arts* will be eſteemed by the *great Things* they perform, and not by thoſe they ſpeak: While the old *Philoſophy* could only at the beſt pretend to the Portion of *Nepthali, to give goodly words*, the New will have the Bleſſings of *Joſeph* the younger and the belov'd Son; *It ſhall be like a fruitful Bough, even a fruitful Bough by a Well whoſe Branches run over the Wall: It ſhall have the Bleſſings of Heaven above, the Bleſſings of the Deep that lies under, the Bleſſings of the Breaſts and of the Womb:* While the Old could only beſtow on us ſome barren Terms and Notions, the New ſhall impart to us the Uſes of all the *Creatures*, and ſhall enrich us with all the Benefits of *Fruitfulneſs* and *Plenty*.

*FINIS.*

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